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Introduction

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Scientific and technical reports of the National Aeronautics and Space Administration and its contractors; scientific and technical reports of government agencies, universities, and research organizations throughout the world.

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02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **3504**

03 AUXILIARY SYSTEMS
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **3507**

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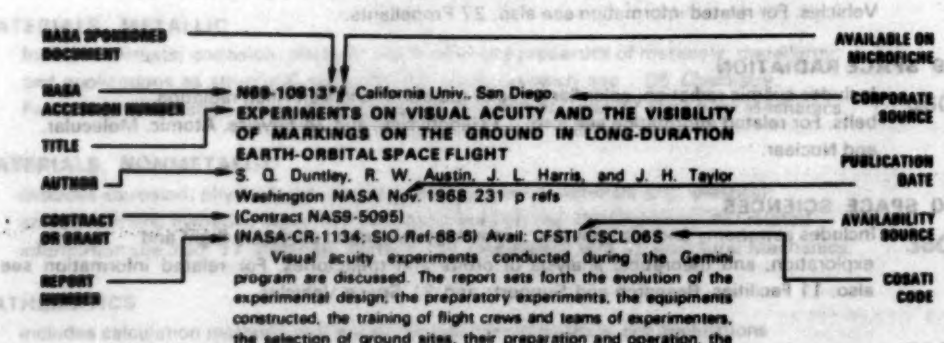
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TITLE
EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
Washington NASA Nov. 1968 231 p refs
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(Contract NAS9-5095)
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REPORT NUMBER
(NASA-CR-1134; SIO-Ref-68-6) Avail: CFSTI CSCL 06S
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N69-33210*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF JET EXHAUST LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A JET V/STOL MODEL

Arthur W. Carter Washington Jul. 1969 135 p refs

(NASA-TN-D-5333) Avail: CFSTI CSCL 01A

A wind tunnel investigation of the jet location interference effects on the longitudinal aerodynamic characteristics of a jet V/STOL model has been made for an unswept untapered wing with an aspect ratio of 8 and 30 percent chord slotted flaps. The effects of jet location were explored systematically from several wing chord lengths ahead to several chord lengths behind the wing. Various vertical locations were also investigated. Aerodynamic and pressure data are presented. Author

N69-33237*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUPERSONIC AERODYNAMIC CHARACTERISTICS AND SHOCK STANDOFF DISTANCES FOR LARGE-ANGLE CONES WITH AND WITHOUT CYLINDRICAL AFTERBODIES

James F. Campbell Washington Aug. 1969 97 p refs

(NASA-TN-D-5334) Avail: CFSTI CSCL 01A

Results of this study indicated that all the cone configurations were statically stable with the moment center located at the cone base. Addition of cylindrical afterbody sections resulted in increases in stability throughout the Mach number range. Axial force increased as cone semiapex angle was increased, a maximum being approached for the flat disk. Throughout the angle-of-attack range, addition of cylindrical afterbody sections resulted in reductions in axial force that were not more than 4 percent for all combinations of cone semiapex angles and cylinder lengths and were less than 3 percent for most combinations. Normal force and lift decreased as cone semiapex angle was increased, minimum values being obtained for the flat disk; an increase in these forces resulted when cylindrical afterbody sections were added. Shock standoff distance for any body with a detached shock wave appeared to be uniquely dependent on the inverse square of the density ratio across a normal shock. This dependence allowed shock standoff distance for the conical bodies to be adequately predicted within the test range of cone semiapex angles and Mach numbers. Author

N69-33276*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL INVESTIGATION OF AN STOL AIRCRAFT CONFIGURATION EQUIPPED WITH AN EXTERNAL-FLOW JET FLAP

Lysle P. Parlett and James P. Shivers Washington Aug. 1969 86 p refs

(NASA-TN-D-5384) Avail: CFSTI CSCL 01A

The present investigation was performed to provide information on the static longitudinal and lateral characteristics of a proposed short take-off and landing (STOL) transport configuration utilizing the jet-flap principle. Longitudinal tests were conducted at engine gross-thrust coefficients of from 0 to 3.4 through a range of angle of attack which included the stall; and lateral tests were made, both power-off and power-on, through a sideslip range of ±30° at angles of attack of 0° and 10°. Untrimmed lift coefficients up to 7.8 were attained at a gross-thrust coefficient of 2.83 in the tail-off condition. With the tail on, nearly all high-lift conditions were characterized by a marked longitudinal instability which began at an angle of attack of 7°. The instability was apparently caused by the tip vortices which, under the influence of the highly loaded center section of the wing, were drawn into the region of the horizontal tail. The tail-on configuration was directionally stable and had positive dihedral effect at all flap and power settings tested; and in the take-off and landing conditions increasing power increased directional stability and decreased dihedral effect. With one outboard engine not operating, the model could be trimmed laterally and directionally up to lift coefficients of 4.2 in the take-off condition and 5.7 in the landing condition. Author

N69-33291*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LUDWIEG TUBE PILOT TEST AND HIGH REYNOLDS NUMBER TEST EQUIPMENT

John W. Davis *In its* Res. Achievements Rev., Vol. 3 1968 p 11-16 refs (See N69-33289 19-31)

Avail: CFSTI CSCL 01A

To obtain data concerning Reynolds number effects at test conditions considerably higher than simulated in existing facilities, a relatively simple and inexpensive wind tunnel capable of simulating Reynolds numbers of the order of 400 million (based on vehicle length) over the subsonic, transonic, and supersonic speed ranges. Test equipment and operating concepts are described along with experimental results obtained in a pilot test program. Author

N69-33302*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC INTERFERENCE EFFECTS CAUSED BY PARALLEL-STAGED SIMPLE AERODYNAMIC CONFIGURATIONS AT MACH NUMBERS OF 3 AND 6

John P. Decker Washington Aug. 1969 85 p refs
(NASA-TN-D-5379) Avail: CFSTI CSCL 01A

A wind tunnel investigation has been conducted to examine the aerodynamic interference effects associated with simple three dimensional aerodynamic configurations placed parallel and in close proximity to each other. The configurations were 10° half-cone bodies that varied in length and were tested with and without simple delta wings. The flat surfaces of the configurations were adjacent to each other during testing. The effects of vertical spacing and relative incidence angle between the configurations were measured, and the resulting data were used to determine the influence of relative body size, nose bluntness, and lifting surfaces on the longitudinal aerodynamic characteristics of the lower configuration at Mach numbers of 3 and 6. Increasing the size of the upper configuration generally caused a progressive decrease in the normal-force-curve slope and a progressive decrease in the static longitudinal stability of the lower configuration. For the upper configuration larger than the lower configuration, the data suggest some form of progressive blanketing since the normal-force-curve slope decreases to zero and even negative values at some of the vertical spacings investigated. Increasing the incidence angle of the upper configuration generally caused nose-up increments in the pitching-moment coefficient and negative increments in the normal-force coefficient of the lower configuration. Author

N69-33448*# Midwest Research Inst., Kansas City, Mo.
STUDY OF INDICIAL AERODYNAMIC FORCES OF MULTISTAGE SPACE VEHICLE SYSTEMS. VOLUME 1: APPLICATION OF THEORY TO BASIC GEOMETRIES AND TO THE SATURN 5 Final Report, 28 Jun. 1967–27 Sep. 1968
William D. Glauz and Robert R. Blackburn 27 Sep. 1968 119 p refs
(Contract NAS8-21167; MRI Proj. 3089-P)
(NASA-CR-61928) Avail: CFSTI CSCL 01A

This two-volume report contains the results of a study of unsteady aerodynamics of axially symmetric vehicles. The work is based on an indicial potential theory which yields the aerodynamic forces resulting from a unit step side wind gust. The theory is linear and is applicable in the low supersonic speed range to body geometries which possess axial symmetry. The indicial results, in turn, are used with a Duhamel or convolution integral approach to obtain frequency response data and aerodynamic responses to measured wind profiles. It was found that resonances may occur, the major factor being the vehicle shape. In particular for profiles containing conic and cylindrical portions the local normal forces on the cylindrical areas are likely to have a resonant frequency; whereas, the local normal forces on the conic portions do not. The total normal force and pitching moment for the Saturn V exhibit a resonance to winds with a spatial wavelength of about 80 meters, as well as several other resonances at shorter wavelengths which roughly correspond to the interstage lengths. All of these resonances are of approximately the same magnitude as the zero-frequency response. Author

N69-33449*# Midwest Research Inst., Kansas City, Mo.
STUDY OF INDICIAL AERODYNAMIC FORCES ON MULTISTAGE SPACE VEHICLE SYSTEMS. VOLUME 2: USER'S MANUAL FOR THE AERODYNAMICS COMPUTER PROGRAMS Final Report, 28 Jun. 1967–27 Sep. 1968
William D. Glauz and Geraldine Coombs 27 Sep. 1968 100 p refs
(Contract NAS8-21167; MRI Proj. 3089-P)
(NASA-CR-61408) Avail: CFSTI CSCL 01A

Developed is a theory of accurately predicting unsteady indicial aerodynamic forces on a body of revolution. By indicial, we mean the forces resulting when the vehicle encounters a side gust in the form of a step function. Since this theory is linear, it can be used with an integral or convolution approach to calculate aerodynamic forces associated with arbitrary side winds. The object of the current contract is to apply the integral approach by developing the necessary computer programs and then using the programs to study several selected problems. This manual contains the information and instructions for users of these computer programs. Author

N69-33928# National Physical Lab., Teddington (England). Aerodynamics Dept.
CALCULATIONS SHOWING THE INFLUENCE OF AERODYNAMIC DAMPING ON BINARY WING FLUTTER
N. C. Lambourne Aeron. Res. Council 1969 18 p refs Supersedes NPL-AERO-1236; ARC-29264
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The influence of damping is examined by comparing the flutter critical speeds and frequencies obtained using the complete equations of motion and those obtained when all the damping terms are omittnd. The calculations are made for binary flexure-torsion flutter of a wing in incompressible flow and the comparisons extend over ranges of values of the principal parameters. Author (ESRO)

N69-34020# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE SUBCRITICAL RESPONSE AND FLUTTER OF A SLENDER WING MODEL AIRCRAFT
D. B. Payen and P. R. Guyett Aeron. Res. Council 1969 34 p refs Supersedes AAE-TR-67-225; ARC-29916
(ARC-R/M-3572; RAE-TR-67-225; ARC-29916) Copyright. Avail: CFSTI: HMSO: 15s 6d

An aeroelastic model aircraft of slender planform has been tested in a wind tunnel at low subsonic speeds. The tests comprised measurement of the resonant frequencies and dampings of the first five symmetric modes of deformation with the model mounted on a novel low-stiffness support at mean angles of incidences of +15°, +5°, 0°, −5°, −15°. For zero incidence the speed range was extended to include measurements at speeds up to the critical flutter speed. The results were compared with calculated values based on the five measured still air modes and rigid body motions of the model on its support. Good agreement was obtained for the response in the model deformation modes 1, 2, 3 and 5, and the flutter speed and frequency were predicted accurately. In the mode which became unstable, however, the calculated damping values were somewhat lower than the measured values at subcritical wind speeds. Author (ESRO)

N69-34050# ARO, Inc., Arnold Air Force Station, Tenn.
WIND TUNNEL TESTS ON THE APACHE SOUNDING ROCKET WITH VARIOUS SPIN RATES AT SUPERSONIC SPEEDS Final Report
James C. Uselton and Jack B. Carman AEDC May 1969 43 p refs
(Contract F40600-69-C-0001)
(AD-687441; AEDC-TR-69-57) Avail: CFSTI CSCL 19/7

Aerodynamic characteristics were investigated for a 0.355-scale model of the Apache sounding rocket at Mach numbers 2 to 6. Free-stream Reynolds number, based on model length, was varied between 6,500,000 and 23,900,000, and angle of attack varied from -5 to 15 deg. The model was tested without fins at spin rates up to 4,000 rpm and with fins at cant angles of 0, -1, and plus or minus 2 deg, which produced spin rates ranging from about -3200 to 3200 rpm. Tests of the complete spinning model showed significant changes in side loading with angle of attack, Mach number, and Reynolds number. Tests of the model with and without

fins allowed a degree of accessment of the relative body and fin Magnus contributions. Tests of the nonspinning model with and without fins showed significant side loads attributed to steady asymmetric leeward vortex patterns. Author (TAB)

N69-34205# Indian Inst. of Tech., Kanpur. Dept. of Mechanical Engineering

CALCULATION OF COMPRESSIBLE TURBULENT BOUNDARY LAYER ON A FLAT PLATE

S. V. Patankar Aeron. Res. Council 1969 18 p refs Supersedes ARC-29564

(ARC-CP-1027; ARC-29564) Copyright. Avail: CFSTI; HMSO 4s 6d

Calculations are presented of the compressible turbulent boundary layer on a flat plate. They have been made by a new, general, accurate and economical procedure. The physical inputs chiefly comprise: (1) a form of the mixing-length hypothesis, and (2) the assumption of a uniform effective Prandtl number. The predictions are compared with available experimental data and empirical correlations; the agreement is satisfactory. It is pointed out that the same method may be expected to give good predictions even in more complex situations. Author (ESRO)

N69-34211# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.

EXPERIMENTS ON THE FLOW PROCESSES IN SIMPLE ROTATING CHANNELS

H. S. Fowler Jan. 1969 83 p refs

(AD-687918; DME-ME-229) Avail: CFSTI CSCL 13/7

The character and distribution of flow in the channels of a large-scale model of a centrifugal compressor impeller are explored and measured. In order to make a more detailed study of the flow that has been discovered, a new series of tests has been carried out. The complete rotor was replaced by simplified models of single channels, in which the flow could be compared while the channel was stationary, or rotating. These two-dimensional channels were given a range of divergence angles, and the flow was compared with that in stationary diffusers. Channel-exit speed and stability profiles are presented covering ranges of channel divergence angles, and Reynolds and Rotation Numbers. Smoke visualization pictures enable the flow within and downstream of the channel to be seen, and show the location of the flow detachment point on the suction wall. Author (TAB)

N69-34240# ARA, Inc., West Covina, Calif.

GAP EFFECTS OF A SHARP EDGED DELTA WING AT SUPERSONIC SPEEDS

Bernard Mazelsky, Chia-Chun Chao, and Cheng-Chung Shen Feb. 1969 58 p

(Contract F44620-68-C-0027)

(AD-687491; ARA-102; AFOSR-69-0846TR) Avail: CFSTI CSCL 1/3

Sonic boom measurements were conducted to evaluate the effects of a leading slat with various degrees of camber and gap size between the slat and the main wing on a 70 deg swept delta wing at supersonic speeds. The model was sized for sonic boom measurements in a wind tunnel. In addition to these measurements, the model was instrumented with several pressure taps for indicating the flow through the gap. As a separate wind tunnel entry, force measurements were also taken to indicate the effect of the cambered slat on the pitch stability and lift-drag ratio. Due to the small size of the model required to measure the sonic boom, the gap configuration was such that the airflow was normal to the wing surface. For optimum lift and drag performance, the gap should be designed such that the flow from the upper surface should be tangential to the upper surface. A second model has been constructed to evaluate the lift-drag problem separately by increasing the size of the model such that the proper gap configurations can be fabricated. Regardless of the non-optimization of the gaps, the following results were established by this phase of the program. (1) The effect of camber results in an increase in (L/D)max. (2) The effect of Reynolds Number on (L/D)max is negligible when the gap is closed. However, for a very small gap, a slight increase in (L/D)max occurs with increasing Reynolds Number. (3) For the case of zero and 11 deg camber, the reduction of overpressure due to the gap is approximately 5%. For the case of the 7 deg camber, no reduction is apparent. Author (TAB)

N69-34301# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN EXPERIMENTAL INVESTIGATION OF PRESSURE DISTRIBUTION ON THE END OF A COOLED BLADE

V. M. Kapinos et al Mar. 1969 15 p refs Transl. into ENGLISH from Energ. Mashinostr. (USSR), no. 5, 1967 p 128-134

(AD-687231; FTD-MT-24-398-68) Avail: CFSTI CSCL 21/5

The pressure distribution on the end plane of a cooled blade was studied in order to facilitate control of the cooling air flow rate. The test stand consisted of a centrifugal compressor, a combustion chamber, a mixing chamber, a honeycomb damper, the test section with the investigated cascade profiles, a fuel-feed system, a control panel, and monitoring instrumentation. The investigated cascade consisted of five cylindrical blades, only one of which was cooled. The blades had a chord of 121.7 mm, a height of 120 mm, and a pitch of 83.3 mm. The mounting of the blades provided a shock-free inlet flow. The cooling air was supplied from the main flow. The pressure distribution in the radial clearance was studied with respect to the following factors: (1) air flow rate through the cascade; (2) size of the radial clearance; (3) cooling air flow rate through the blade channels; and (4) the total effect of the three factors. Author (TAB)

N69-34432# Princeton Univ., N.J. Dept.of Aerospace and Mechanial Sciences.

THE STABILITY OF A TWO-DIMENSIONAL INCOMPRESSIBLE WAKE Interim Report

George E. Mattingly, Jr. Dec. 1968 214 p refs

(Contract AF 49(638)-1656)

(AD-688499; AFOSR-69-1430TR; Rept-858) Avail: CFSTI CSCL 1/3

The inviscid linearized stability analysis was used to examine the growth of disturbances in the two-dimensional wake of a thin airfoil. Through a combined stability analysis, wherein small disturbances are permitted to grow in both time and space, the relationship between the disturbance characteristics for the temporal and spatial reference frames is shown. Qualitative as well as quantitative differences are found to exist between the characteristics of the most highly amplified disturbances obtained for the two reference frames. In the wake stability analyses, two types of disturbances are considered. The first type has a transverse velocity component that is symmetrical with respect to the wake centerplanes. The second has a transverse velocity component which is antisymmetric with respect to the wake center plane. It is found that the most highly amplified disturbances in the wake region analyzed are those of the first type. Experiments concerning the downstream development of the wake of a thin airfoil were conducted in a water tank using the hydrogen bubble technique and the hot film anemometry. The mean-velocity profiles at successive downstream locations were determined and utilized in the stability analyses. Author (TAB)

N69-34485# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE INFLUENCE OF WIND TUNNEL FLOW DISTRIBUTION AND TURBULENCE ON THE MEASUREMENT OF MAGNUS FORCES
Anders S. Platou Apr. 1969 26 p refs
(AD-688601; BRL-MR-1969) Avail: CFSTI CSCL 20/4

A series of Magnus tests were carried out in a 4 ft. supersonic unitary tunnel at Mach numbers 1.5 and 2.0 and compared with Magnus tests run on the same model in a 13 in x 15 in supersonic tunnel. The tests show that the greater turbulence and flow variations in the 4 ft. tunnel test region influence the Magnus data so that the data are accurate only 10% to 15%. Flow variations over longer models will undoubtedly be greater and the inaccuracy of Magnus data will also be greater. Author (TAB)

N69-34558# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE POSSIBILITY OF SIMULATING CAVITATION PHENOMENA IN TESTING CENTRIFUGAL PUMPS ON GASES
N. S. Enshov Feb. 1969 16 p refs Transl. into ENGLISH from Ziv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), v. 10, no. 4, 1967 p 79–87
(AD-687226; FTD-MT-23-1093-68) Avail: CFSTI CSCL 13/11

The possibility is discussed of modelling cavitation phenomena in bladed machinery by using gaseous substances. A sonic operating regime can be achieved by gradually reducing the gas temperature at a constant rpm and flow rate. In such cases, the pump cavitation qualities in model tests using gaseous media will be similar to those found in pumps using liquid media. Mathematical analyses of the cavitation at the inlet and outlet of centrifugal pump rotors indicate that conditions for cavitation formation are more favorable at the rotor inlet than at the outlet. In compressors, a supersonic velocity at the rotor exit does not produce a significant pressure drop, since the guide vanes are designed for such velocities. Apparently, substantial losses will occur at supersonic velocities in pumps provided with spiral volutes. For this reason, in testing pumps by using gaseous media, a pressure drop may occur when supersonic velocities occur aft of the rotor. It is quite possible that supersonic velocities in the spiral volute will not produce a sudden pressure drop. Author (TAB)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-33201# Army Natick Labs., Mass. Office of the Scientific Director.
ANALYSIS OF A PARACHUTE WITH A PULLED-DOWN VENT
Edward W. Ross, Jr. Feb. 1969 43 p refs
(AD-687307; TR-69-71-OSD) Avail: CFSTI CSCL 1/3

The analysis for flat circular canopies in steady descent is here extended to deal with canopies having a pulled-down vent. A general theory is developed, and a partial, approximate solution is found in closed form for certain conditions. The general theory is taken as the basis of a computer program. An example is worked out to demonstrate the use of the program in determining the optimum length of center line. The results are compared with tests and fairly good agreement is obtained. The most interesting outcome is the prediction that the maximum fabric stress is greatly reduced by pulling the vent down. Author (TAB)

N69-33227# Kamak Aircraft Corp., Bloomfield, Conn.
PASSIVE HELICOPTER ROTOR ISOLATION USING THE KAMAN DYNAMIC ANTIRESONANT VIBRATION ISOLATOR (DAVI)
Erich P. Schuett Fort Eustis, Va. Army Aviation Mater. Labs. Dec. 1968 176 p refs
(Contract DA-44-177-AMC-420(T))
(AD-687324; R-710; USAAVLABS-TR-68-46) Avail: CFSTI CSCL 1/3

The report contains the analysis and results of a study to determine the feasibility of rotor isolation employing the Dynamic Antiresonant Vibration Isolator (DAVI). The theoretical analysis was conducted employing a two-dimensional DAVI for lateral and vertical isolation with conventional isolation in the longitudinal direction. Steady-state and transient inputs were analyzed. The steady-state analysis includes all six degrees of freedom of the upper body and of the lower isolated body of the helicopter. Statistical data and excitation criteria were established to study the effects and determine the feasibility of rotor isolation for a range of statistical aircraft ranging from 2000 pounds to 100,000 pounds. Also discussed are the effects of rotor isolation on control motions, crash loads, mechanical instability, and system reliability. Results of the feasibility study show that rotor isolation employing the DAVI is feasible. Isolation is feasible at the predominant frequency (N/rev) and all its multiples up to 4N/rev. Low static deflection at a minimum weight penalty are some of the features of the DAVI system. Author (TAB)

N69-33436*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
IMPROVING AUTOMATIC LANDING SYSTEM PERFORMANCE USING MODERN CONTROL THEORY AND INERTIAL MEASUREMENTS
Duncan MacKinnon Jan. 1969 155 p refs
(Contract NAS12-602)
(NASA-CR-86186; R-628) Avail: CFSTI CSCL 01C

Conventional automatic landing system designs for commercial transports have been primarily based on the utilization of Instrument Landing System (ILS) information to provide the position information required for acquisition and tracking of the glide path. Inertial navigator position and velocity is relatively free from the high frequency noise which plagues ILS information, however, erroneous, low frequency, gyro drift induced, variations in position and velocity exist. The possibility of combining the desirable low frequency characteristics of the ILS sensor with the broad bandwidth of the inertial information is suggested. By applying a systematic mathematical estimation technique to the signals from the ILS and inertial navigator it is possible to correct the inertially measured position and velocity. The result is position and velocity information which is relatively free from noise compared to the information provided by the ILS. Optimization theory is applied to synthesize trajectories which the vehicle can follow (in the absence of disturbances) without saturating the effectors. This report develops the new control system structures and compares the performances of new and conventional automatic landing systems. Author

N69-33585# Army Material Command, Washington, D.C. Systems and Cost Analysis Div.
A CONCEPTUAL ANALYSIS SURVEILLANCE AND ARMED AERIAL VEHICLES (MANNED AND UNMANNED)

William J. Tropf, Stephen J. Lanigan, and W. Allen Gilchrist, Jr. Apr. 1969 33 p
(AD-687295; TR-69-15) Avail: CFSTI CSCL 15/7

This study is a conceptual analysis of drones in the aerial surveillance and armed aerial vehicle role. Generic manned and unmanned aerial subsystems are compared against a generalized mission to address the question: what happens if we have drones; and why we have drones, on a first level basis. Further discussion includes resource requirements and certain more abstract considerations such as the value of manned space probes and how the emphasis on manned spacecraft vs a corresponding emphasis for unmanned areial vehicles can be reconciled. The major findings of the authors are threefold. Drones presently offer no capability which could not conceivably be achieved with a manned system, but certain missions may be better accomplished by unmanned systems. The question then, is a matter of degree rather than additional capability. Secondly, under certain conditions and for specific types of missions drones may represent a more cost effective choice in the current time frame; and these cases should become more pronounced as the state-of-the-art progresses. Finally, the most significant advantage of having drones is that along with manned aircraft they represent a system offering considerable flexibility of choice to the field commander. Author (TAB)

N69-33569# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
A METHOD FOR DETERMINATION OF OPTIMUM VEHICLE SIZE AND FREQUENCY OF SERVICE FOR A SHORT HAUL V/STOL AIR TRANSPORT SYSTEM
R. W. Simpson and M. J. Neuve Eglise May 1968 44 p refs Presented at the 1968 ORSA/TIMS Natl. Meeting, San Francisco, May 1968
(Contract C-136-66)
(PB-183013; FTL-R-68-1) Avail: CFSTI CSCL 15E

To compete successfully in short haul markets under 200 miles, an air transport system must offer a high daily frequency of service, N, as well as short air travel times. In a given market, N can be increased by using vehicles of smaller seat capacity, C, which are more expensive per seat to operate. A method of determining optimal values of N and C for assumed market behavior in terms of fare and time elasticities is presented. Author (USGRDR)

N69-33622*# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.
SOLAR-TRACKER BALLOON FLIGHTS 3048, 3049, AND 3050 Final Report
R. D. Conlon Nov. 1968 46 p Prepared for JPL
(Contracts NAS7-100; JPL-952223; Proj. 59684)
(NASA-CR-103872; Rept-3269) Avail: CFSTI CSCL 01C

High altitude, solar-cell calibrations were accomplished during July and August 1968, using balloon techniques. Solar-cell modules were flown on balloon-mounted solar trackers at a nominal 80,000-foot altitude to obtain zero-air-mass performance data. Fifty-two solar cells were calibrated on two flights. The third and final flight of this program contained five solar cells and a special radiometer. Accurate data were telemetered and recorded during each flight and reduced to computer-compatible punch cards. The operational details of the flights, discussion of instrumentation changes made during the program, and a tabulation of secondary temperature and calibration data recorded during the program are reported. Author

N69-33623*# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.
SUNTRACKER BALLOON FLIGHTS 3042, 3043, 3044, AND 3045, 1967 Final Report
R. D. Conlon 21 Sep. 1967 49 p Prepared for JPL
(Contracts NAS7-100; JPL-951910)
(NASA-CR-103873; Rept-3149) Avail: CFSTI CSCL 01C

High-altitude solar-cell calibration was conducted during July and August 1967, using balloon techniques. Solar-cell modules were flown on three 80,000-ft flights and one 120,000-ft flight. Accurate solar-cell output data was telemetered and recorded during each flight. The operational details of the flights, discussion of instrumentation improvements made during the program, and a tabulation of secondary temperature and calibration data recorded during the program are reported. Author

N69-33750# Boeing Co., Renton, Wash. Commercial Airplane Div.
ANALYSIS OF ELECTRIC WARNING SYSTEMS
Adel Mohsen May 1969 121 p refs
(AD-687764; D6-23763-TN) Avail: CFSTI CSCL 1/2

It is the purpose of this study to provide a systematic technique for the classification of warning systems, and to develop a methodology of analysis for the determination of the relative safety of the various methods used in electric warning systems. The aim of this approach is to ensure that future safety designs will be improved. Author (TAB)

N69-33765# General Dynamics/Convair, San Diego, Calif.
MODEL FUSELAGE CRASH IMPACT STUDY Final Report
D. L. Greer, T. L. Heid, and J. D. Weber Apr. 1969 89 p refs
(Contract FA-67-WA-1541) (AD-687772; FAA-DS-69-2) Avail: CFSTI CSCL 1/3

This study demonstrates the accuracy and efficiency of an analytical method for predicting crash impact effects on fuselage structure. A digital computer program, developed as a tool for improving the crashworthiness of fuselage structure was used to predict the impact effects on model fuselage test specimens. Crash impact tests of these models then provided actual data for correlation with the analytical predictions. The analytical versus test comparisons showed good agreement. Fuselage bending moments, vertical decelerations and lower shell deformations were compared. Both the analytical and test result data plots of moments and decelerations show the high frequency and fundamental vibratory modes. The data indicates that the analytical method provides accurate predictions of fuselage response to crash impact and that the method can be a valuable tool in the design of crashworthy fuselage structure. Author (TAB)

N69-33781# Royal Inst. of Tech., Stockholm (Sweden).
AIR CUSHION VEHICLES (ACV) IN WATER TRANSPORT. A CRITICAL ANALYSIS OF FUTURE POSSIBILITIES AND APPLICATIONS IN SCANDINAVIA
Olle Ljungstrom 1968 220 p refs /*ts* ACTA Polytech. Scand., Mech. Eng. Ser. 35
(PB-182980; APS-ME-35) Avail: CFSTI CSCL 13J

Based on amphibious air cushion vehicle (ACV) technology, development stage in 1968 and prospects for the next decade, possibilities for future civil transport ACV operations in Scandinavian waters are analyzed technically, economically and with due consideration of competition in the future transport market development. State of the art in various aspects of ACV technology is reviewed. A critical analysis of ACV applications and operations is carried out. Author (NSA)

N69-33827# Weapons Research Establishment, Adelaide (Australia).
ANALYTICAL INVESTIGATION OF SPINNING BEHAVIOUR AND RECOVERY FROM THE DEVELOPED SPIN OF A 65 DEG DELTA-WING AIRCRAFT CONFIGURATION USING A HIGH-SPEED DIGITAL COMPUTER

R. Wilson Sep. 1968 59 p refs
(WRE-TN-HSA-137) Avail: CFSTI

An analytical investigation of the nature of the spin behaviour and possible means of recovery from the developed spin for a 60° delta-wing aircraft configuration was made using a high-speed digital computer. Details of the computational technique and aerodynamic characteristics of the configuration are described. Author

N69-34003# Boeing Co., Renton, Wash. Commercial Airplane Div.
STEERING EFFECTIVENESS COMBINED WITH HEAVY BRAKING FOR THE 737 NOSE GEAR
Herbert Domandl Mar. 1969 22 p refs
(AD-687763; D6-58384-7TN) Avail: CFSTI CSCL 1/3

An analysis of the case of combined steering and braking for a 26 ×8.0-14 type VIII aircraft tire has been conducted. It has been shown that with a properly working antiskid system the steering effectiveness will be maintained when brakes are applied. The full available ground friction can always be utilized to counteract side forces acting on the nose wheel by exceeding the nose wheel steering angle at which the brake system is cut out. With or without braking, as long as the available ground friction is sufficient to handle these side forces, steering effectiveness will be maintained. Author (TAB)

N69-34070# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
PERFORMANCE AND STABILITY OF HYPERVELOCITY AIRCRAFT FLYING ON A MINOR CIRCLE Interim Report
A. M. Drummond Dec. 1968 175 p refs
(Grant AF-AFOSR-222-66)
(AD-687444; UTIAS-135) Avail: CFSTI CSCL 1/3

The equations of motion pertinent to the study of steady and perturbed motion of a rigid vehicle flying on a minor circle at constant altitude above a spherical non-rotating Earth are derived. Solutions to the steady-state equations (performance) and perturbation equations (stability) are presented in the form of altitude-speed regions where flight is possible, and root loci, respectively. The linearization of the perturbation equations is examined and performance boundaries are discussed. The principal conclusions are that steady flight is limited mainly by available thrust, and that characteristic oscillations about steady flight condition are poorly damped. Minor instabilities were found in all cases examined. New characteristics not present in conventional flight, are discussed-they involve the movement of the vehicle mass-centre relative to the flight trajectory. A representative vehicle was chosen for which numerical values were obtained. Author (TAB)

N69-34104# Southwest Research Inst., San Antonio, Tex.
INHERENT VIBRATION DAMPING OF HELICOPTER BLADES Interim Technical Report, Jan. 1968–May 1969
Wilfred E. Bakar May 1969 51 p refs
(Contract DA-31-124-ARO(D)-356)
(AD-687313) Avail: CFSTI CSCL 1/3

Results are presented of extensive experiments on damping of vibrations in helicopter main rotor blades and compare these results with theoretical and semiempirical methods of predicting blade damping. The feasibility of numerical solution of blade vibration equations which include complex damping effects is demonstrated. Air damping is shown to be relatively unimportant for all but the fundamental bending vibration mode. Structural damping is essentially independent of amplitude but varies significantly with frequency. For much of the experimental data, internal damping of the blade material is the primary source of damping. Author (TAB)

N69-34390# RAND Corp., Santa Monica, Calif.
AIRCRAFT COMBAT RADIUS CALCULATION PROCEDURE FOR VARIOUS MISSION PROFILES AND EXTERNAL-STORE CONFIGURATIONS
C. M. Weber Apr. 1969 69 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-688482; RM-5948-PR) Avail: CFSTI CSCL 1/3

An extension and revision of the HARD-1 (Handy Approximate Radius Determination) combat radius calculation procedure described in RM-5280 for aircraft carrying external stores. HARD-3 calculates the radius capability for a particular aircraft having known climb and cruise performance, fuel consumption, drag, etc. The method is somewhat more complex than HARD-1 but it provides greater flexibility and improved accuracy: a wider choice in cruise conditions is now available, and the effect on radius of non-distance-gaining fuel allowances is computed more accurately. The computer program allows for variation in the disposition of empty fuel tanks and for target-bound refueling. Although designed specifically for a ground-attack mission, the procedure may be adapted for other missions. The results compare favorably with estimates made by following the mission-planning procedures described in military flight manuals. The JOSS program is included, along with a sample set of calculations and an explanation of the equations used. Author (TAB)

N69-34404# Royal Aircraft Establishment, Farnborough (England).
INVESTIGATION OF THE INTERNAL AERODYNAMICS OF A MODEL HOVERCRAFT
I. L. Keiller May 1968 33 p refs
(RAE-TR-68098/UL) Copyright. Avail: CFSTI

Tests to investigate how various factors influence the hovering performance of an air cushion vehicle have been made. The results showed how substantial aerodynamic losses may readily occur in a hovercraft. Although the tests were made with a rigid jet model, the results are shown also to be relevant to a skirted hovercraft where the volume flow into the cushion may be of more importance than daylight clearance. Author

N69-34408# Royal Aircraft Establishment, Farnborough (England).
CORRELATION OF DECCA VHF EQUIPMENT MALFUNCTIONS WITH DEGREE OF STATIC ACTIVITY RECORDED DURING FLIGHTS WITH AN S6IN HELICOPTER IN THUNDERSTORM CONDITIONS
M. E. Rogers and Elsie B. Minihan May 1968 22 p refs
(RAE-TR-68131/UL) Copyright. Avail: CFSTI

Static discharge records obtained during flights in an S6IN helicopter through cloud and rain associated with an active thunderstorm area are analyzed and the data correlated with malfunctions of the aircrafts Decca navigator and VHF equipment. Interpretation of these results indicate that properly sited passive wick dischargers will prevent noisy airframe corona discharges, even under severe charging conditions, but that lightning discharges, will, either directly or indirectly, result in unacceptable levels of interference. Suggestions for ways of further reducing static generated radio frequency interference in high charging environments include the use of circuits designed to block short duration disturbances associated with lightning flashes, coating dielectric surfaces with a durable antistatic composition, and the development of active discharger systems capable of discharging several milliamperes of current. Author

N69-34454# Boeing Co., Renton, Wash. Commercial Airplane Div.
A COMPARISON OF THE OPERATION AND FRICTION CHARACTERISTICS OF AIRPLANE AND DRAGSTER TIRES
Herbert Domandl May 1969 22 p refs
(AD-688669; D6-58384-4TN) Avail: CFSTI CSCL 1/3

A qualitative answer is given to the frequently raised question about the differences in friction performance of a braking aircraft tire and a driving Dragster tire. The dissimilarities in design criteria and usage of these two types of tires are discussed. The energy input into the contact area is recognized as the major factor for the differences in performance between driving and braking tires. Author (TAB)

N69-34484# Army Foreign Science and Technology Center, Washington, D.C.
ON AN AIR CUSHION
V. Pyshnov May 1969 17 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 2, 1966 p 66–71
(AD-688531; FSTC-HT-23-1003-68) Avail: CFSTI CSCL 20/4

The lifting capacity of various types of aircraft and particularly of helicopters and air cushion vehicles, is examined. The formulas used for calculating the lifting capacity of the various machines are given and their aerodynamic properties are described. Author (TAB)

N69-34489# Army Foreign Science and Technology Center, Washington, D.C.
TURBINE-POWERED MI-8, NEW EQUIPMENT FROM THE FIVE YEAR PLAN
V. A. Kuznetsov May 1969 12 p Transl. into ENGLISH from Grazhdanskaya Aviatsiya (Moscow), v. 25, no. 2, 1968 p 15–16
(AD-688528; FSTC-HT-23-902-68) Avail: CFSTI CSCL 1/3

A description of the MI-8 medium helicopter. This machine is available in both fraight and passenger versions, and either version can be converted for ambulance service. The characteristics of this turbine-powered helicopter are presented in table form. Drawings and photographs are presented. Author (TAB)

N69-34683# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ROTOR JET POWER ALTERNATE SYSTEMS Final Report
Robin B. Gray and James E. Hubbartt Mar. 1969 246 p refs
(Contract N00014-67-A-0159-0002)
(AD-688470; GIT-AER-69-1) Avail: CFSTI CSCL 1/3

Results are presented from a theoretical investigation of the comparative performance of several helicopter rotor jet power alternate systems in hovering and forward flight. The common component in all systems is the gas generator which supplies the working fluid to drive and control the helicopter as follows: a turbine for shaft power; a tip jet; a jet flap; and a combination of jet flat and tip jet. Several different propulsion cycles are considered, the cold cycle and the regenerative cycle in less detail and the hot cycle in more detail. The results are graphically presented in a form suitable for performance comparison purposes and illustrative examples are given. Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-33230# Army Electronics Command, Fort Monmouth, N.J.
FEASIBILITY INVESTIGATIONS OF HYDRAZINE-AIR BI-CELLS
John Perry, Jr. Mar. 1969 20 p refs
(AD-687292; ECOM-3108) Avail: CFSTI CSCL 10/1

The use of hydrazine-air bi-cells, capable of operating with high fuel concentrations and with an inherent electrolyte circulation system, is another approach to the simplification of fuel cell power sources. Investigations have established the feasibility of operating self-contained small bi-cells at high currents. Bi-cells sized for use in the 60/240 watt hydrazine-air manpack power supply have delivered 6 and 14 amperes, at a minimum of 0.6 volts operating on an 18 minute/2 minute duty cycle. Author (TAB)

N69-33262# Army Electronics Command, Fort Monmouth, N.J.
FAST TRANSIENT RESPONSE FUEL CELL: BATTERY HYBRID POWER SOURCE
Galen R. Frysinger Jan. 1969 9 p refs
(AD-687260; ECOM-3104) Avail: CFSTI CSCL 10/2

The integration of a molten carbonate fuel cell with a molten electrolyte battery both electrically and thermally produces a highly efficient power source with a fast transient response. Since most practical high pulse applications utilize electronic chopping circuits, microsecond and millisecond response characteristics of a power source are of importance. Ceramic monoblock construction of a hybrid package can be designed with optimum response characteristics as well as the ability to accept high reverse power flow. Author (TAB)

N69-33268*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GUIDANCE AND CONTROL DIVISION
In its Supporting Res. and Advanced Develop. 30 Apr. 1969 p 119–148 refs (See N69-33263 19-31)
Copyright. Avail: CFSTI CSCL 10B

Surface reactions during oxidation and reduction of alkaline silver electrodes and the effects of additives and sterilization processes on these reactions are discussed. Performance tests on thermoelectric and radioisotopic generators continued with preliminary analyses of the degradation processes involved. Self alignment procedures as well as the transfer into the alignment loop are described for a strapdown electrically suspended gyro aerospace navigation system. The optimal bounded retrothrust control problem is used to analyze terminal conditions of soft landing and the implementation of theoretical results is considered. Results of Curie-point switching experiments with manganese bismuth films show that transfer characteristics depend on spot size and heating time. G.G.

N69-33270*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENVIRONMENTAL SCIENCES DIVISION
In its Supporting Res. and Advanced Develop. 30 Apr. 1969 p 171–175 (See N69-33263 19-31)
Copyright. Avail: CFSTI CSCL 10B

Design and performance of a test model arc lamp with a water cooled anode for solar simulation purposes is described. Anode characteristics are analyzed by varying flow rates and gap dimension pressures within the available pumping system. Results show that the inlet minus outlet pressure is approximately constant for a given flow rate and gap dimension. Higher pressures are obtained by increasing inlet pressure and restricting flow rate at the outlet, thus raising both the outlet preasure and the inlet minus outlet pressure. Interpolated output curves for a solar simulator operating with 300-psig inlet pressure and a 4 to 5 gal/min flow rate produces an inlet minus outlet pressure of 180 psig. A multiple anode structure, consisting of three tungsten tipped water cooled copper anodes and a tungsten cathode in argon gas operated at 75 psi with the cathode light spot time modulated to the extent of 10%. G.G.

N69-33348*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COULOMETER AND THIRD ELECTRODE BATTERY CHARGING CIRCUIT
John Paulkovich, inventor (to NASA) and Floyd E. Ford, inventor (to NASA) Filed 29 May 1969 30 p
(NASA-Case-GSC-10487-1; US-Patent-Appl-SN-828983) Avail: CFSTI CSCL 10B

A coulometer and a third-electrode circuit are used for controlling the charging current applied to nickel-cadmium batteries. The coulometer is connected in parallel with a current limiting means such as a trickle resistor. At least one of the battery cells is of the type having a third electrode which is connected to a third electrode resistor in series with the trickle resistor. A voltage sensing circuit detects the sum of voltages across the coulometer and the third electrode. When the sum of the voltages exceeds a predetermined level, the sensing circuit actuates a control means, e.g., dissipating or switching regulator, for preventing further flow of charging current to the battery. The device may be further provided with a current limiting resistor connected in series with the coulometer, and either in series with or in parallel with the trickle resistor. NASA

N69-33422*# TRW Systems Group, Redondo Beach, Calif.
CHARGED PARTICLE RADIATION DAMAGE IN SEMICONDUCTORS. PART 14: STUDY OF RADIATION EFFECTS IN LITHIUM DOPED SILICON SOLAR CELLS
R. C. Downing, J. R. Carter, R. E. Scott, and W. K. Van Atta 27 May 1969 153 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952251)
(NASA-CR-103788; TRW-10971-6014-RO-00) Avail: CFSTI CSCL 10B

Float zone lithium doped solar cells after 3×10^{14} e/cm^2 at 1.0 MeV have exhibited recovered maximum power points as high as 95% under solar illumination and about 90% under tungsten illumination. Similarily after 3×10^{15} e/cm^2 recovered maximum power points of 80% under solar illumination and 70% under tungsten illumination have been observed. In each case room temperature half anneal times are of the order of an hour. Crucible lithium doped solar cells exhibit the same recovery characteristics at about 80°C while being considerably slower at room temperature. Redistribution and carrier removal studies indicate a lithium removal rate during irradiation of 0.05 cm^{-1} which appears to result in a lithium-vacancy defect site active as a recombination center. Subsequent annealing results in further loss of lithium, implying a lithium-vacancy-lithium defect site which is inactive in the recombination process resulting in recovery of electrical characteristics. Minority carrier lifetime versus temperature measurements on both crucible and float zone lithium doped solar cells further confirm the absence of the A-center as a dominant recombination site in lithium doped n-type silicon. Author

N69-33424*# Metals and Controls, Inc., Attleboro, Mass. Research and Development Labs.
HEAT STERILIZABLE AND IMPACT RESISTANT Ni-Cd BATTERY DEVELOPMENT Quarterly Report, 1 Jan.–31 Mar. 1969
P. V. Popat, R. L. Crawford, J. M. Gondusky, and E. J. Rubin 31 Mar. 1969 120 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951972)
(NASA-CR-101123; QR-7) Avail: CFSTI CSCL 10B

The development of heat sterilizable, impact resistant, hermetically sealed nickel cadmium batteries suitable for rigorous space requirements is discussed. Heat sterilized, prismatic, 17 and 18 plate cells have satisfactorily completed numerous charge-deep discharge cycles without capacity loss or malfunction. A basic design and fabrication procedure for a crimped polymeric hermetic seal has been established, several prototypes fabricated and leak tested. A high impact test facility has been established for Ni–Cd cell shock resistance testing, with a capability of accelerating a 50 lb. carriage mass to 125 ft. per sec. Preliminary testing of Ni–Cd cells under this environment has begun. Author

N69-33442*# Union Carbide Corp., Cleveland, Ohio. Parma Technical Center.
DEVELOPMENT OF FUEL CELL ELECTRODES. TASKS 1 AND 3: ELECTRODE IMPROVEMENT AND LIFE TESTING Final Report, 30 Jun. 1966–30 Apr. 1968
M. B. Clark, R. L. Baum, J. D. Grigsby and W. C. Thurber 31 Jul. 1969 142 p
(Contract NAS3-9430)
(NASA-CR-72576) Avail: CFSTI CSCL 10B

Program goals were an operating lifetime of 3000 hours, with an initial voltage above 0.9 volt and a voltage degradation less than 40 millivolts per 1000 hours, at a current density of 200 ASF for thin electrodes. Moderately pressurized cells (30 psia) have demonstrated the feasibility of meeting the voltage goal and voltage degradation rate goal, with a longest operating lifetime (within these specifications) of 2,450 hours. Principal problem areas were delamination of cathodes, and weepage of electrolyte into the oxygen gas passages, which was reduced but not completely eliminated. Author

N69-33444*# Tyco Labs., Inc., Waltham, Mass.
ALUMINUM CHLORINE BATTERY Quarterly Report
Jose Giner and Brian Burrows Oct. 1968 28 p refs
(Contract NAS12-688)
(NASA-CR-86195; QR-1) Avail: CFSTI CSCL 10B

A molten salt system based on Al and Cl_2 carbon electrodes with an $AlCl_3$-alkali chloride eutectic as electrolyte offers promise as a rechargable, high energy density battery, which can operate at a relatively low temperature and may withstand sterilization. With the aim of developing such a system, work was carried out to obtain pure $NaCl-KCl-AlCl_3$ electrolytes and to do preliminary studies of both Al and Cl_2 electrodes. Different commercial aluminum chloride materials were investigated. Using cyclic voltammograms it was found that the major impurity in all these materials is Fe^{3+}. A treatment with highly dispersed Al powder was partially successful in purifying this electrolyte. Investigation of the Al anode shows the feasibility of steady state current densities up to 50 ma/cm^2, both in cathodic and anodic directions. At higher current densities, transients are observed which can be interpreted as being due to passivation by formation of a layer of solid salt. Author

N69-33447*# Electro-Optical Systems, Inc., Pasadena, Calif.
DEVELOPMENT OF THERMIONIC CONVERTERS Quarterly Progress Report
Dean Jacobson and Randy Hamardinger 15 Jul. 1969 17 p Prepared for JPL
(Contracts NAS7-100; JPL-952255)
(NASA-CR-103835; EOS-4018-Q-2; QPR-2) Avail: CFSTI CSCL 10B

This is a second quarterly progress report. It is a 20-month program to design and develop low-power, high-efficiency thermionic converters of cylindrical geometry. The converters will be capable of being integrated to form a modular power supply. The central philosophy of this approach is to increase the reliability of thermionic space power supplies by redundancy of the basic component. Seven converters and a bombardment heater unit are deliverable items per the contract statement of work. The converter development is to proceed in an iterative fashion whereby each converter design is reviewed separately and approved before fabrication. Subsequent performance data are reviewed separately, and will formulate the basis for redesign. Author

N69-33479*# Electric Storage Battery Co., Raleigh, N.C. Exide Missile and Electronics Div.
HIGH CYCLE LIFE 30 AH SEALED SILVER OXIDE-ZINC CELL DEVELOPMENT Quarterly Report, 14 Feb.–14 May 1969
C. D. Ferris 16 Jun. 1969 28 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952472)
(NASA-CR-103824; ESB-E-23-69; QR-I) Avail: CFSTI CSCL 10B

The object of the report is to develop a silver oxide-zinc sealed cell capable of 90%-50% depth of discharge cycles after a 7-month interplanetary trip to Mars and a 1-2 months charged stand before launch. Cell pack design, new separator evaluation, initial development of wedge shaped teflonated negative plate and procurement of cycle life test panels are presented. Cells were designed and are in production for a cycle life experiment requiring 90%-70% to 50% depth of dicharge cycles. Twelve cell design modifications are included. Author

N69-33489*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.
STUDY OF LITHIUM DOPED SOLAR CELLS Final Report
Peter A. Iles 11 Jun. 1969 35 p Prepared for JPL
(Contracts NAS7-100; JPL-952250)
(NASA-CR-103827) Avail: CFSTI CSCL 10B

The improved control of all cell fabrication steps, allowing closer grouping of the cells shipped for irradiation, has been developed. Better understanding was gained of the effects on cell properties caused by the different methods of silicon growth, and by the various lithium diffusion schedules. Continued efforts were made to find the best way to introduce lithium into the cells, by a method suited to scaling-up. The boron trichloride diffusion process appeared to affect cell properties far more than previously expected. Alternate boron diffusion methods showed promise, in allowing better evaluation of the various silicon crystal growth methods and also in enabling new structures to be made. Author

N69-33589*# Naval Research Lab., Washington, D.C. Solid State Applications Branch.
SOLAR CELL RESEARCH Semiannual Report, 16 Oct. 1968–15 Apr. 1969
15 Apr. 1969 44 p refs
(Contract NAS7-100; NASA Order WO-8056)
(NASA-CR-103854) Avail: CFSTI CSCL 10B

Solar cell research was conducted and the results of these studies are reported. Specific accomplishments include: (1) Thermal annealing at room temperature of radiation damage induced in lithium-diffused silicon by 1 MeV electrons at 77°K was studied by Hall effect measurements. The results indicated that both lithium (Li^+) and lithium paired with oxygen (LiO^+) are available for the annealing of damage. (2) A study of low flux Co^{60} gamma irradiation of lithium-diffused silicon solar cells has revealed the presence of a continuing damage stage in the cell parameters after prolonged exposure. (3) Successful implantation of boron in a silicon semiconductor device has been achieved by means of a focused controlled boron ion beam. (4) Preliminary measurements of the parameters of silicon solar cells at 80°K have indicated that the cell efficiency generally improves with decreasing temperature; however, in some instances, cell contacts have exhibited non-ohmic behavior below 200°K. (5) A computer program has been written for analyzing the diode parameters of a solar cell by a least-squares process. Author

N69-33590*# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
ACTION OF LITHIUM IN RADIATION-HARDENED SILICON SOLAR CELLS Final Report, 23 Apr. 1968–21 Apr. 1969
G. J. Brucker, T. J. Faith, and A. G. Holmes-Siedle 21 Apr. 1969 119 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952249)
(NASA-CR-103871; AED-R-3440) Avail: CFSTI CSCL 10B

The results of a program to study and analyze the action of lithium in producing a recovery of radiation damage in silicon solar cells is reported. The work performed has advanced the understanding of the defect interactions, dynamics, and general prospects of lithium solar cells. The dynamics of lithium in silicon has been studied under conditions analogous to those which would be experienced in a practical lithium solar-cell array in a high-flux trapped specs-radiation situation, namely in orbit near Earth, Jupiter or any other planet. Tests on GFE cells irradiated to fluences from 10^{14} to 10^{16} e/cm^2 indicates that, to obtain good long-term stability in cells made from silicon of low oxygen content, the lithium density should be made as low as is compatible with maximum cell recovery for the fluence applied to the cells. Cells with high lithium concentration and steep gradients of lithium density near the junction show gross lithium motion near the junction over ~ 1 year. Author

N69-33620*# General Electric Co., Schenectady, N.Y. Research and Development Center.
REDUCED GRAVITY BATTERY TEST PROGRAM Final Report, 20 Aug. 1968–20 Feb. 1969
Mar. 1969 89 p Prepared for JPL
(Contracts NAS7-100; JPL-952121)
(NASA-CR-103851; S-69-1081) Avail: CFSTI CSCL 10C

The design, construction, and testing of a breadboard unit capable of investigating the behavior of secondary Ag-Zn batteries in the zero-g environment of an earth orbit were studied. Three types of test are to be performed automatically in sequency by the equipment. These tests verified the adequacy of the solid state logic test programming approach used, the data acquisition methods employed, and established that average power levels for the complete equipment were within the target specification. Tests of two of the experiments yielded highly repeatable results which closely checked previous measurements. Task 1 tests of plain zinc electrodes showed a 55% reduction of limiting current density under simulated zero-g conditions. Task 3 tests of commercial quality Ag-Zn cells showed surprisingly little loss in discharge capacity until after 10 stress cycles to 100% depth of discharge. Results of tests of the Task 2 experiment did not agree with earlier bench top experiments. Some of the differences noted were attributed to differences in electrode construction, and some to deficiencies in the gas management system employed. Author

N69-33768# European Space Research and Technology Center, Noordwijk (Netherlands).
THE PHOTOVOLTAIC EFFECT IN THE Cu-Cd-S SYSTEM
A. E. Van Aerschot, J. J. Capart, K. H. David, M. Fabbricotti, K. H. Heffels et al Jan. 1969 46 p refs Presented at the 2d Photovoltaic Specialists Conf., Pasadena, Calif., 19–21 Nov. 1968
(ESRO-SN-99-ESTEC) Avail: CFSTI

Models of the photovoltaic cell proposed by various authors are subjected to a critical examination to isolate their underlying assumptions and to devise possible experimental tests of the models. The results of an investigation of a model in which the Cu_2S layer plays an active role are presented. These include a calculation of spectral response and a comparison of calculated and measured spectral response curves; an electron microprobe study whose conclusion is that the Cu_2S layer is thinner than 0.5 μm; a discussion of the 'cross-over' of dark and light I-V characteristics and a test of whether this shift is adequately explained by an internal series resistance; and a study of the effects of low-energy proton irradiation on the properties of Cu-Cd-S cells. Author (ESRO)

N69-33787# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGNING ELECTRICAL SUPPLY SYSTEMS FOR AIRCRAFT (EXCERPTS)
G. D. Vlasov Feb. 1969 253 p refs Transl. into ENGLISH from the book 'Proektirovanie Sistem Elektrosnabzheniya Letatelnykh Apparatov' Moscow, Izd., 1967 p 3–77, 142–165, 189–237, 305–328, 392–413
(AD-687245; FTD-HT-23-1182-68) Avail: CFSTI CSCL 10/2

The book represents an attempt to tie together theoretical questions and optimal practical solutions and recommendations for the designing of electrical supply systems, methods of development and formulation of technical documentation, determination of weight and reliability criteria, selection of optimal configuration and protection of supply network, and principles of construction of the most reliable primary and secondary A-C and D-C power systems. The book contains systematized data on primary and secondary power systems, optimal variants of transmission systems, distribution of electrical energy, types of protection for electrical networks, and a comparative appraisal and recommendations for selection of optimal power supply systems. Author (TAB)

N69-33801*# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
SEPARATOR DEVELOPMENT FOR A HEAT STERILIZABLE BATTERY Final Report, 1 Jun. 1968–31 Dec. 1968
L. C. Scala, A. Langer, G. D. Dixon, R. G. Charles, C. R. Ruffing et al 14 Apr 1969 126 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951525)
(NASA-CR-103888) Avail: CFSTI CSCL 10C

Battery separator materials capable of withstanding a sterilizing cycle of 60 hours in 40% KOH at 135°C were fabricated using a continuous dip-coating process. The final separator coating formulation chosen for best results consists of a 3:1 mixture by weight of previously dried and ball-milled 20:50 mesh Bio-Rad hydrated zirconia filler, with Union Carbide PS 1700 polysulfone in dimethylacetamide (DMAC), in the presence of 1% by solid weight of a wetting agent. This mixture mixture is coated on to non-woven, KOH-resistant polypropylene tape (Webril EM 476, 0.0027 inch thick, or Pellon 2140, 0.007 inch thick) by a continuous dip-coating process. The resulting composite is passed through a dioxane:water bath, where the solvent DMAC still present is leached out and the polysulfone is precipitated as a continuous solid film on the tape. This action results in the formation of extremely small pores throughout the composite through which passes the electrolyte. Author

N69-33824*# Texas Instruments, Inc., Attleboro, Mass. Research and Development Labs.
HEAT STERILIZABLE Ni-Cd BATTERY DEVELOPMENT Quarterly Report, 1 Oct.–31 Dec. 1968
R. W. Sorensen and R. L. Crawford Jun. 1969 46 p Prepared for JPL
(Contracts NAS7-100; JPL-951972)
(NASA-CR-103839; QR-6) Avail: CFSTI 10B

The development of heat sterilizable, hermetically sealed Ni–Cd cells for space applications is presented. This report includes the electrochemical characterization of sterilized 17 plate factorial design cells. An analysis of variance of the calculated factor effects has shown that concentration and amount of electrolyte do affect the electrochemical characteristics, but that the significance of their effect is difficult to estimate because of the small number of cells involved. Both core compression and separator wettability were investigated as possible causes for the lack of reproducibility of cycling data. Wettability studies have shown that the separators having the best absorption characteristics are also those that do not stand up under the sterilization process. The high end-of-charge voltage is being investigated. An experiment to test the effect of sterilization on components both alone and in certain combinations was also carried out. The impact testing facility set up at Brown University is described. Author

N69-33835# Sundstrand Aviation, Rockford, Ill.
ORGANIC RANKINE CYCLE TECHNOLOGY PROGRAM Quarterly Progress Report, 1 Jul.–1 Oct. 1968
R. E. Niggemann 15 Oct. 1968 80 p refs
(Contract AT(04-3)-851)
(PB-182882; SAN-651-71; QPR-10) Avail: CFSTI CSCL 10A

The purpose of the program is to investigate the technology necessary to successfully develop an organic Rankine cycle power conversion system capable of long duration operation in a space environment. The specific working fluids to be evaluated are biphenyl and the eutectic mixture of biphenyl and biphenyl ether. Author (USGRDR)

N69-33915# Sonotone Corp., Elmsford, N.Y.
DESIGN IMPROVEMENT OF BB 501( )/ BATTERY ASSEMBLY Final Report, 29 Mar. 1967–Nov. 1968
John Pivarnik Ft. Monmouth, N.J. ECOM Mar. 1969 143 p
(Contract DAAB07-67-C-0380)
(AD-687336; ECOM-0380-F) Avail: CFSTI CSCL 10/3

The objective of this design improvement contract was to perfect a 20-cell, 24 volt, 14 A. H. nickel-cadmium storage battery more rugged, economical, and maintainable, as well as lighter, than the original BB501()/U. This was accomplished by combining existing design features with ones incorporated in the BB610()/U. The production requirement for sixty-five batteries on an unqualified basis was completed. In addition, four improved units were qualified in accordance with two required environmental tests: the four-foot random drop test, and the three-foot water immersion test. For the results of these tests, Sonotone test-data sheets are given. Included in this report are the official indented BB501()/U parts list and a full set of manufacturing drawings. In addition, there are illustrations showing design improvements to the battery as described in the text. Author (TAB)

N69-34026# Union Carbide Corp., Parma, Ohio. Fuel Cell Dept.
SIMPLIFIED HYDRAZINE-AIR FUEL CELL Quarterly Report, 4 Nov. 1968–3 Feb. 1969
M. B. Clark and K. V. Kordesch Ft. Monmouth, N.J. ECOM May 1969 27 p
(Contract DAAB07-69-C-0083)
(AD-687897; ECOM-0083-1; QR-1) Avail: CFSTI CSCL 10/2

This report discusses the goal to improve the performance of a hydrazine-air fuel cell to meet higher requirements. The desired level of performance has been raised to a minimum voltage of 0.70 volt at 8 amperes and 0.65 volt at 14 amperes. It was obvious that the first requirement would be to reduce the resistance drop introduced by the membrane. As a result, the original membrane separator has been abandoned in favor of a protective coating applied directly to the electrodes. Additional protection has been provided by a double-anode construction. The hydrazine is now injected between the anodes instead of being fed into the anode-cathode space. Further protection results from the use of reversed cathodes in which the active carbon layer is separated from the electrolyte by a porous nickel barrier; with the previously used electrodes, the carbon was in direct contact with the electrolyte. Bicells of specified dimensions have been studied and samples built. At this stage of the work it is felt that the major obstacles have been overcome, and the final cell design has been essentially established. Author (TAB)

N69-34379*# Gulf General Atomic, San Diego, Calif.
RADIATION EFFECTS IN SILICON SOLAR CELLS Quarterly Report
J. A. Naber, B. C. Passenheim, and R. A. Berger 10 Jul. 1969 38 p refs Prepared for JPL
(Contract NAS7-100; JPL-952387)
(NASA-CR-104066; GA-9483) Avail: CFSTI CSCL 10b

The nature of the defects responsible for the output degradation of silicon solar cells irradiated by space radiation, particularly the effects of lithium on the production and annealing of damage in silicon, is investigated. Samples of high purity silicon have been lithium diffused by the paint-on and lithium-tin bath techniques. Samples of various lithium content have been prepared, and the lithium content is being measured by room temperature resistivity and neutron activation analysis techniques. Both neutron and electron irradiation programs have been initiated. Lifetime degradation rates at 273°K and 302°K have been measured as a function of neutron fluence. From isochronal and isothermal anneal data the annealing kinetics appear to be first order and are controlled by the diffusion rate of lithium in silicon. Results of the effect of the lithium concentration on the degradation and annealing of electron-irradiated lithium-diffused n-type silicon have been obtained. An electron spin resonance study of the irradiation production and anneal of the divacancy has been initiated. Author

N69-34447# Army Electronics Command, Fort Monmouth, N.J.
STANDARD FAMILY OF POWER SOURCES FOR MANPACK EQUIPMENTS
John L. Moncrief Jan. 1969 23 p refs
(AD-687263; ECOM-3075) Avail: CFSTI CSCL 10/2

Physical and electrical characteristics of a proposed standard family of power sources for manpack equipments are presented. Versatility is achieved by the application of a variety of electrochemical systems in appropriate cell sizes which results in a wide range of capacities, energy densities, and other factors of importance to field application. Each member of the family will have a standard manpack configuration horizontal cross section and will have an identical physical and electrical interface which will mate with a standard equipment interface to form an integral equipment-power source manpack assembly. Thus the operator will not be limited to a single, unique power source for his equipment for all missions, but will be able to select a power source to match the mission. Author (TAB)

N69-34482# Junta de Energia Nuclear, Madrid (Spain).
ISOTOPIC ENERGY GENERATORS
G. Dominguez [1967] 40 p refs In SPANISH Presented at the Symp. on Appl. of Radioisotopes, Madrid
(CONF-670649-18) Avail: AEC Depository Libraries

Energy generators have been developed within the past few years which use radioisotopes either as primary sources of energy or in direct conversion methods. The development of these types of generators is outlined. The methods used for the conversion of radioactive decay energy are described. Specific areas for the application of isotopic energy generators are reviewed. NSA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology

N69-33379# Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.
FOOD CONSERVATION BY IRRADIATION EXPOSURE [LA CONSERVATION DES ALIMENTS PAR IRRADIATION]
E. Denti and E. Zimmer 1968 15 p In FRENCH Presented at Reunion Europack, Varese, Italy, 21 Jun. 1968
(SORIN-149; M/354) Avail: CFSTI

Several types of food, beef, pork, poultry, and fish were studied for the changes irradiation treatment made in their preservation. Fruits were also studied. The results show germination inhibition of bulbs and nodules, slowing of fruit maturation, conservation of orginal vegetable foods, and partial or total destruction of microorganisms as some of the positive aspects of the food preservation study. The temperature factor and the length of time the food was to be preserved were also taken into consideration. Transl. by E.H.W.

N69-33384# Educational Testing Service, Princeton, N.J.
ROBBINS-MONRO PROCEDURES FOR TAILORED TESTING
Frederic M. Lord Mar. 1969 45 p refs
(Contract N00014-69-C-0017)
(AD-687471; RB-69-18) Avail: CFSTI CSCL 5/10

Tailored testing tries to choose for administration items at a difficulty level matching the examinees ability, which is inferred from his responses to items already administered. Robbins-Monro procedures for selecting items and for estimating the examinees ability are evaluated. Various ideas of use for tailored testing emerge. Author (TAB)

N69-33390# Library of Congress, Washington, D.C. Aerospace Technology Div.
RESPONSE OF THE NERVOUS SYSTEM TO MICROWAVE RADIATION
Vladimir Mutschall *In its* Foreign Sci. Bull., Vol. 5, No. 6 Jun. 1969 p 16–55 refs (See N69-33388 19-16)
Avail: CFSTI

Current Soviet research on the effects of microwave radiation on the mammalian nervous system is reviewed. Author

N69-33382*# Public Health Service, Phoenix, Ariz. National Communicable Disease Center.
REDUCTION OF MICROBIAL DISSEMINATION GERMICIDAL ACTIVITY OF ETHYLENE OXIDE Summary Progress Report Number 12
Apr. 1969 9 p
(NASA Order R-137)
(NASA-CR-103822) Avail: CFSTI CSCL 06C

Development of techniques for recovering and culturing airborne particulates containing *Clostridium perfringins* are discussed. The reinforced clostridial agar showed the best results of seven different agar bases that were screened. Naturally airborne microorganisms were collected with exposed filters assayed for approximate number of viable particulates and with the remaining filters subjected to ethylene oxide sterilization. Filters exposed to ethylene oxide were cultured aerobically in 10% CO_2 at 37°C and examined for growth following 14 and 28 days of incubation. No surviving microorganisms were observed. J.A.M.

N69-33383# Joint Publications Research Service, Washington, D.C.
RADIOBIOLOGY
Oak Ridge, Tenn. AEC 1968 244 p refs Transl. into ENGLISH of Radiobiologiya (Moscow), v. 8, no. 4, 1968 p 1-238
(AEC-TR-7014) Avail: CFSTI

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33. ON THE ROLE OF THE DOSE RATE IN PREPLANTING γ-IRRADIATION OF POTATOES Yu. V. Voropaev, L. S. Lur'e, V. T. Parfenov, and V. S. Serebrenikov p 213–216 refs

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36. INFLUENCE OF RADIATION ON THE PROLIFERATION AND DIFFERENTIATION OF CELLS I. L. Chertkov p 225–231 (See N69-33396 19-04)

N69-33394# Joint Publications Research Service, Washington, D.C.
AN EXPERIMENT ON CHRONIC GAMMA-IRRADIATION OF RATS WITH A VARIABLE DAILY DOSE OF THE INFLUENCE
V. N. Malakhovskii, A. I. Laptev, A. F. Khoruzhenko, I. G. Oreshkin, and V. A. Rezontov *In its* Radiobiol. 1968 p 52–59 refs (See N69-33393 19-04)
Avail: CFSTI

A total of 298 rats were subjected to chronic γ-irradiation with linear variation of the daily dose in the direction of a decrease for one group of animals (series A) and in the direction of an increase for the other (series B). At the same time, a model was formulated: the contribution of each daily fraction to the cumulative effect of irradiation is determined by the size of the fraction with its characteristic effectiveness. A prognosis made on the basis of the proposed model basically coincided with the actual experimental results. The differences in death rate between series A and B proved to be directly opposite to what were expected on the basis of the widespread Blair–Davidson hypothesis. Author

N69-33395# Joint Publications Research Service, Washington, D.C.
INITIAL MECHANISMS OF THE DEVELOPMENT OF RADIATION DAMAGE TO THE CELL
B. I. Medvedev *In its* Radiobiol. 1968 p 220–224 (See N69-33393 19-04)
Avail: CFSTI

Physiochemical aspects of the origin and development of radiation damage in the cell were studied. The significance of the target theory as a mathematical analysis of a strictly unlimited circle of phenomena was emphasized. The nonequivalence principle is proposed for reflecting phenomena that occur during irradiation of a cell. While the role of free radicals, chain processes, intercellular membranes, and radiotoxins are discussed, emphasis is placed on the damage and the recovery of DNA to irradiation. J.A.M.

N69-33396# Joint Publications Research Service, Washington, D.C.
INFLUENCE OF RADIATION ON THE PROLIFERATION AND DIFFERENTIATION OF CELLS
I. L. Chertkov *In its* Radiobiol. 1968 p 225–231 (See N69-33393 19-04)
Avail: CFSTI

The physiological regeneration of hematogenetic tissue and intestinal epithelium, after irradiation, is reviewed. Biochemical aspects of radiation action and postradiation recovery, hematogenetic stem cells, hematogenesis (development and differentiation of hematogenetic cells), lymphopoiesis and its immune response, and tumor cells are also discussed. J.A.M.

N69-33423*# Naval Aerospace Medical Inst., Pensacola, Fla. Medical Center.
VESTIBULAR RESPONSES TO SINUSOIDAL ANGULAR ACCELERATION STIMULI WITH SUPERIMPOSED OFFSET VELOCITIES
Jorma I. Niven and W. Caroll Hixson 2 Apr. 1969 14 p refs
(NASA Order R-93)
(NASA-CR-103793; NAMI-1065) Avail: CFSTI CSCL 06S

Thirty subjects were exposed to a sinusoidal rotation stimulus of 0.025 cps and a peak velocity of 63 deg/sec, which was superimposed on a constant rotational velocity of 153 deg/sec clockwise (CW), 153 deg/sec counterclockwise (CCW), or 0 deg/sec. The phase lag of nystagmus and sensation directional transitions was determined and used to derive a functional index. Nystagmus-based values were found to be independent of the base velocity and its direction. The phase lag of the CCW-to-CW transition in sensation of turning increased with a CCW offset velocity and decreased with a CW offset. The opposite effect was observed for a CW-to-CCW transition. Author

N69-33523*# Stanford Univ., Calif.
EVALUATION OF THE CARDIOVASCULAR SYSTEM DURING VARIOUS CIRCULATORY STRESSES Progress Report, 1 Sep. 1968–1 May 1969
Donald C. Harrison, Harold Sandler, Lewis Wexler, and Robert Goldman 1 May 1969 12 p refs
(Grant NGR-05-020-305)
(NASA-CR-103789) Avail: CFSTI CSCL 06P

Cardiac reserve before and after myocardial infarction was evaluated by studying drug responses in experimental animals. Observed were elevated arterial pressure, heart rate performance, and stress effects produced by coronary artery ligation. Circulatory responses to dopamine, lidocaine, and morphine chemotherapy indicated that dopamine was the preferable agent for the treatment of severely depressed cardiac function following acute myocardial infarction and that the infusion of lidocaine seemed to be the best therapy in patients with comprised circulatory function after the infarct. Morphine sulfate injections in dogs after acute myocardial infarction produced sustained hear rate decreases and heart rate outputs. Also performed were studies with implanted ultrasonic flow transducers and reflected ultrasound for evaluating cardiac performance in man and animals. The use of ultrasound for detecting changes in the transplanted human heart centered on immunological rejection changes with thickening of the left ventricular wall. G.G.

N69-33527*# California Univ., Berkeley. Lawrence Radiation Lab.
JOINT NASA-AEC PROGRAM IN SPACE RADIATION BIOLOGY Progress Report, Fall 1967
Sep. 1967 139 p refs Prepared jointly with NASA
(NASA ORDER R-104; Contract W-7405-eng-48)
(NASA-CR-103674; UCRL-17751) Avail: CFSTI CSCL 06R

The data presented pertain to molecular and cellular studies, radiation effects in space flight, radiological physics, and mammalian radiobiology and neuroradiobiology. For individual titles, see N69-33528 through N69-33546.

N69-33531*# California Univ., Berkeley. Lawrence Radiation Lab.
EFFECTS OF HOMOGENEOUS MAGNETIC FIELDS UPON BIOLOGICAL SYSTEMS
Nabil M. Amer *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 25–28 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

The hypothesis that the effects of homogeneous magnetic fields on the development of *Tribolium confusum* incubated at constant ambient temperature were quantitatively equivalent to an intrinsic cooling effect of the order of 1° C/6000 gauss was tested with substances with mesomorphic states, which when cooled have the characteristic of changing their light-scattering properties as a function of temperature. The change is expressed in a shift of the wavelength of scattered light. When a mesomorphic state with a range of coloration between 34° and 37° C was maintained at an ambient temperature of 37° C ±0.1° and an external magnetic field of 6.3 kG was applied to the preparation, a gradual change in the wavelength of the scattered light was obtained (a shift from 4600 to 6200 Å). K.R.G.

N69-33532*# California Univ., Berkeley. Lawrence Radiation Lab.
THE EFFECT OF VARIOUS LET RADIATIONS ON STEM CELLS AS MEASURED BY THE SPLEEN COLONY-FORMING TECHNIQUE
Jose M. Feola and John C. Schooley *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 29–36 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

A series of experiments dealing with irradiations of bone marrow cells in suspension and assay in vivo by the spleen colony-forming method were performed. The LAF_1 female mice were irradiated at 1.22 meters from a ^{60}Co source at a dose rate of 12.5 R/min in air. A dose of 1150 rads was given to all recipient mice. After irradiation, groups of five mice were housed in sterilized cages and allowed to drink chlorinated water containing 0.5% to 1.0% Terramycin. Results are based from a series of preliminary experiments. Survival curves obtained by irradiation of the bone marrow cells with X-rays are in good agreement with published reports. Results obtained by irradiation with helium-4 ions are in good agreement with previous results with tumor cells. K.R.G.

N69-33533*# California Univ., Berkeley. Lawrence Radiation Lab.
SYNERGISTIC ACTION OF X-RAYS AND ULTRASONIC WAVES ON MAMMALIAN CELLS CULTURED IN VITRO
Bambino I. Martins *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 37–41 (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

Experiments were performed to elucidate the nature and mechanism of the action of ultrasound and the relationship of such action to that of ionizing radiation. The work was done with mammalian cells from a Chinese hamster bone marrow cell line (M3-1) cultured in vitro. The following conclusions were made based on the experimental data: (1) There is a threshold intensity of ultrasound which is required for cell death. Above this threshold intensity the number of surviving cells falls off with increasing intensity. (2) The threshold intensity, as measured in terms of power input to the crystal, depends on the frequency. (3) Even at intensities below threshold there is sublethal damage as indicated by the observation that such cells are affected differently from nonsonicated cells when irradiated later with 50-kVp X-rays. (4) A synergistic effect between ultrasound and X-rays is demonstrated. The degree of synergism depends on the intensity and frequency of ultrasound and the X-ray dose. The synergistic effect is much more evident if the ultrasound follows rather than precedes X-rays; in this case a subthreshold dose of ultrasound causes markedly more lethality than X-rays alone. K.R.G.

N69-33534*# California Univ., Berkeley. Lawrence Radiation Lab.
EFFECT OF RADIATION ON THE DEVELOPING FLOUR BEETLE, TRIBOLIUM CONFUSUM
Brenda M. Buckhold and John V. Slater *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 43–53 (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

A developmental abnormality was studied in the flour beetle, *Tribolium confusum*. When irradiated with 2000 R of X-rays or γ-rays, young pupae develop into adults having a wing abnormality which consists of a median elytral split, elytral blistering, and protrusion of the underlying membranous wings. Various physical and chemical parameters, such as temperature, O_2 tension, and magnetic fields, were shown to alter this response to radiation. One of the parameters studied in detail has been temperature, with which a synergistic effect was found in terms of percentage of wing abnormalities obtained with radiation. Another point of interest is the variation in sensitivity to X-rays (measured by percent wing abnormality) according to the age of the beetles. Larvae are somewhat sensitive to X-rays as far back as 50 hr prepupation, but the sensitivity more than doubles at about 24 hr prepupation. Pupae have two periods of maximum sensitivity at about 10 and 24 hr postpupation, and sensitivity drops to control values at about 30 hr postpupation. K.R.G.

N69-33536*# California Univ., Berkeley. Lawrence Radiation Lab.
ENERGY-LOSS FLUCTUATIONS
Howard D. Maccabee *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 59–61 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

The phenomena of energy-loss fluctuations in traversals by different particles through absorbers has been investigated. A body of theory predicts the energy-loss probability distribution, depending on the number of collisions in the highest (and therefore least frequent) collision energy group. The parameter k is a measure of the number of high-energy collisions. The theory has been verified conclusively only at its end points, i.e., for large k (slower particles in thicker absorbers) and for small k (faster particles in thinner absorbers). In the intermediate region, Vavilov's theory is believed valid, but the experimental evidence has been sparse. The energy-loss distributions were measured for k from 0.003 to 2.23, using 45 MeV and 730 MeV protons, 370 MeV π mesons, and 910 MeV He^{+2} ions in silicon semiconductor detectors of various thicknesses. Good agreement was found with the Vavilov theoretical distributions, and good agreement on the values of the most probable energy loss. K.R.G.

N69-33537*# California Univ., Berkeley. Lawrence Radiation Lab.
SIMULATED SOLAR-FLARE IRRADIATION IN THE LABORATORY
John T. Lyman *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 63–76 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

In order to assess the effects of lunar mission hazards presented by large solar flares which eject high fluxes of protons and helium ions, a solar flare simulation laboratory apparatus was devised. The 910 MeV helium ion beam from the 184-inch synchrocyclotron was chosen. In order to produce a total-body irradiation of the experimental test animal, it is necessary to either enlarge the beam by magnetic scanning or by scattering, so that the beam diameter is greater than the major dimensions of the animal, or to mechanically scan the animal across a small beam. Mechanical difficulties and stress to the animal make the latter procedure impractical. Because of the relative simplicity of the method, scattering the beam was chosen. Further details on adjustment and calibration of the apparatus are given. K.R.G.

N69-33538*# California Univ., Berkeley. Lawrence Radiation Lab.
BEAM SCANNING AND MICROBEAM AT THE 88-INCH CYCLOTRON
Graeme P. Welch *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 77–82 (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

The α-particle beam of maximum energy 120 MeV and proton beam of maximum energy 55 MeV from the 88-inch sector-focused cyclotron covers approximately 0.5 cm diameter at the target position but is quite inhomogeneous in intensity over its cross section. For small targets, scattering by a thin aluminum or graphite foil has been used to obtain approximate uniformity and to increase the area covered, but the useful field is limited, a great deal of intensity is lost, the background is increased, and the energy spread and rate of energy loss spread are increased. For whole-skin irradiation of animals, scattering to increase beam size is impractical. A practical experimental technique devised involves repetitive deflection of the beam in two perpendicular directions at

different frequencies to cover a large surface (up to 12 inches square in the present design) together with a slow rotation of the animal about a longitudinal axis. This scanning system is also useful for small-animal irradiations and removes the limitations of the scattering method. K.R.G.

N69-33539*# California Univ., Berkeley. Lawrence Radiation Lab.
SPACE-RELATED MAMMALIAN RADIOBIOLOGY
Henry Aceto *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 83–95 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

Results are presented for studies on the combined effect of proton irradiation and hypoxia on beagles and studies involving heavy-ion whole body skin irradiation of mice. A germ-free research program has been initiated to examine the significance of radiation-induced infection and the role it plays in the radiation syndrome, especially in terms of long duration space flights. Pilot experiments have been performed to ensure the adequacy of techniques and procedures for this work. In these experiments, Charles River CD-1 germ-free mice demonstrated an increased radioresistance to ^{60}Co γ rays as expressed by a higher median lethal dose than that for conventional animals. These results indicate a general agreement with earlier studies from other laboratories. K.R.G.

N69-33540*# California Univ., Berkeley. Lawrence Radiation Lab.
VESTIBULAR ORGANS: THE STRUCTURE AND FUNCTION OF THE VESTIBULAR ORGANS AS THEY RELATE TO THE MANNED EXPLORATION OF SPACE
Larry W. McDonald and Robert G. Plantz *In its* Joint NASA-AEC Program in Space Radiation Biol. Sept. 1967 p 97–108 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 06P

As a preliminary step in a series of experiments designed to evaluate the effect of space radiation on vestibular structure and function, normal structure and function is examined and summarized. K.R.G.

N69-33541*# California Univ., Berkeley. Lawrence Radiation Lab.
VESTIBULAR ORGANS: TESTING THE FUNCTION OF VESTIBULAR RECEPTORS
Robert G. Plantz and Larry W. McDonald *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 109–116 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 06P

The vestibular system is considered as a black box and attempts are made to describe its function from input–output data. A morphological study of the vestibular system suggested that the sensors are spring-mass systems with considerable friction. The natural input for such a system is acceleration (angular for the semicircular canals and linear for the otoliths); the system dynamics are described by a second order differential equation, if it is a linear system. Van Egmond's equation for the horizontal canal with zero input acceleration is examined. A series of experiments describing the measurement of semicircular canal function is reported. K.R.G.

N69-33542*# California Univ., Berkeley. Lawrence Radiation Lab.
VESTIBULAR ORGANS: RADIATION EFFECTS ON STRUCTURE AND FUNCTION
Larry W. McDonald and Robert G. Plantz *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 117–122 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

In studies using postrotational nystagmus, whole-body ^{60}Co gamma irradiation of rabbits was associated with an increase in the variability of the test results as radiation sickness progressed. A group of 8 animals was irradiated in this way and those receiving 250 to 500 rad showed definite effects as evidenced by increased statistical variation in the postrotational nystagmus response. Radiographic studies of rabbits' heads were made in order to localize the cyclotron-produced particle beam radiation to the vestibule. When either whole-head or localized vestibular irradiation was used in the rabbit, fairly high doses were required to regularly produce alterations in postrotational nystagmus. Control animals often showed periods of several days when they had an increased postrotational response. In electron micrographs, no definite abnormalities in cilia were detected. The most marked finding was the increase in capillary basement membrane thickness, often more than 150 mμ, and the presence of increased amounts of interstitial space. K.R.G.

N69-33543*# California Univ., Berkeley. Lawrence Radiation Lab.
THE RIGHTING REFLEX OF THE FROG AS INFLUENCED BY IRRADIATION
Cornelius T. Gaffey and Victor J. Montoya *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 123 (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

The utricle's stereoscopic sensitivity to irradiation was tested in the frog, *Rana pipiens*. Alpha particles (910 MeV) and deuterons (455 MeV) generated by the 184 inch cyclotron were used in whole body irradiations. Protons (48 MeV) accelerated by the 88 inch cyclotron were employed in localized hindbrain irradiations. Previous studies on frogs' isolated sciatic nerve demonstrated that 300 krad of 910 MeV α particles immediately block conduction of the nerve impulse. It was found that 19 to 22 krad (whole body) of 910 MeV α particles immediately removed the frog's righting reflex response. A desensitization and gradual loss of reflex ability followed 15 to 18 krad. With 10 to 15 krads there was a reduced level of reflex activity indicated by a protracted latency period. However, these lower doses did not eliminate the righting reflex. The effect of whole body irradiation with 455 MeV deuterons gave changes comparable to those induced by 910 MeV α particles. High energy proton hindbrain irradiation seems to produce a loss of the righting reflex at 20 krad, but unlike whole body irradiation this discrete head irradiation requires a postirradiation interval to manifest its destructive effect. K.R.G.

N69-33544*# California Univ., Berkeley. Lawrence Radiation Lab.
THE VESTIBULAR APPARATUS AS INFLUENCED BY LOCALIZED HIGH-ENERGY IRRADIATION
Cornelius T. Gaffey and Victor J. Montoya *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 125 (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

The vestibular apparatus of adult male cats was locally irradiated by 910 MeV α particles generated by the 184 inch cyclotron. Irradiation was restricted to a 1/4-inch diameter alpha beam. The α particle beam was used to irradiate one and then the other vestibular apparatus. Three reflexes were tested to evaluate the radiosensitivity of the vestibular apparatus: (1) the labyrinthine righting reflex (an otolith function), (2) the static head reflex (an otolith function), and (3) vestibular placing reflex (a semicircular canal linear acceleration function). K.R.G.

N69-33545*# California Univ., Berkeley. Lawrence Radiation Lab.
BRAIN IMPEDANCE STUDIES AND THEIR RELATION TO RADIATION EFFECTS IN SPACE FLIGHT

Richard L. Schoenbrun *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 127–136 refs (See N69-33527 19-04)
Avail: CFSTI CSCL06R

A technique for measurement of electrical impedance changes in small volumes of cerebral tissue by use of implanted electrodes was used to study the effects of high-energy particle irradiation on the functional integrity of the central nervous system in the cat. Results revealed tissue conductance changes in response to focal brain irradiation with 910 MeV helium nuclei at dose levels in excess of 10 krad. Immediately following exposure, as soon as recordings could be made (within 30 min), the resistance decreased and the capacitance increased at the site of exposure. Impedance was unchanged at recording sites outside the radiation field. Values returned to the baseline levels until Day 4, when resistance sharply increased and capacitance decreased. This situation remained to time of sacrifice at Day 10. Brain-wave activity recorded from the same electrodes was highly abnormal at the radiation site; there appeared, shortly after exposure, epileptiform seizure bursts and high amplitude spikes. K.R.G.

N69-33599# Joint Publications Research Service, Washington, D.C.
MODELING IN BIOLOGY AND MEDICINE
21 Jul. 1969 53 p refs Transl. into ENGLISH from Modelirovaniye v Biol. i Med. (Kiev), no. 3, 1968 p 31–206 (JPRS-48455) Avail: CFSTI

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N69-33600# Joint Publications Research Service, Washington, D.C.
MATHEMATICAL MODEL OF PURPOSEFUL BEHAVIOR
S. Ya. Zaslavskiy and Z. L. Leybenzon *In its* Modeling in Biol. and Med. 21 Jul. 1969 p 1–9 refs (See N69-33599 19-04)
Avail: CFSTI

Mathematical models are used to develop and investigate the decision making process in human behavior. Of the several methods available for use, the problem was investigated within the confines of a specific problem situation. The set theory and transition processes were used as aids in solving the problem. E.H.W.

N69-33601# Joint Publications Research Service, Washington, D.C.
CORRECT PERCEPTION OF SPEECH INVESTIGATED
I. M. Kreyn *In its* Modeling in Biol. and Med. 21 Jul. 1969 p 10–16 refs (See N69-33599 19-04)
Avail: CFSTI

Experimental results demonstrate that the same acoustic stimuli is perceived differently depending on whether they are component parts of speech signals or are in a non-speech category. Consonants are said to be a characteristic of speech perception while vowels enter the non-speech category. Cited are differences in the aural perception depending on which ear, left or right, the signals enter or are delivered. Results show the right ear as more sensitive in speech material while the opposite is true for melodies and acoustic signals. E.H.W.

N69-33602# Joint Publications Research Service, Washington, D.C.
CORRELATION AND SPECTRUM ANALYSIS OF BRAIN BIOELECTRICS
M. A. Kulikov and S. P. Khozyainova *In its* Modeling in Biol. and Med. 21 Jul. 1969 p 17–24 refs (See N69-33599 19-04)
Avail: CFSTI

An input device has made it possible to detect bioelectric activity of the brain. Programs were developed for the device so impulse frequency graphs, histograms of distribution on interimpulse intervals, and histograms of postimpulse probability could be compared. The algorithms of these programs are described. Digital computers were also used in bioelectric brain activity detection. E.H.W.

N69-33603# Joint Publications Research Service, Washington, D.C.
ORGANIZATION AND OPTIMALITY IN BIOSYSTEMS
Yu. G. Antonomov *In its* Modeling in Biol. and Med. 21 Jul. 1969 p 25–42 refs (See N69-33599 19-04)
Avail: CFSTI

An attempt to apply the concept of organization to the biosystem and indicate the possible optimality of its operation in instructional processes is examined. No adequate models are available to describe the process and attempts to apply existing ones failed. Reasons seem to indicate that no adequate model for independent variables can be made. E.H.W.

N69-33617# Technische Hochschule Munchen (West Germany).
STUDY OF THE FACTORS AFFECTING THE WEIGHT OF SUCKLING PIGS DURING THE WEANING PERIOD [UNTERSUCHUNG UEBER DIE ABHAENGIGKEIT DER FERKELGEWICHTE IM VERLAUFE DER SAEUGEPERIODE]
Philipp Saffer (Ph.D. Thesis) 1969 86 p refs In GERMAN
Avail: CFSTI

Postnatal development of piglets and economical swine production are statistically evaluated by using least square and multiple variance methods to analyze the factors that determine birth and suckling period weights. Results show that litters of 10 to 18 piglets differ little in their median weights after a 35 day period. However, the birth weight of an individual piglet has a marked effect on its weight after weaning. Optimal keeping and feeding conditions can improve overall swine production. Transl. by G.G.

N69-33710# Joint Publications Research Service, Washington, D.C.
HEMODYNAMIC CHANGES IN INDIVIDUALS WORKING UNDER MICROWAVE IRRADIATION
P. N. Fofanov et al 24 Jul. 1969 5 p ref Transl. into ENGLISH from Kardiologiia (Moscow), v. 9, no. 4, 1969 p 124–126 (JPRS-48481) Avail: CFSTI

The changes in the main indices of human hemodynamics under the influence of microwave irradiation are studied in a clinical survey of subjects whose jobs exposed them to ultrahigh frequency electromagnetic radiation from a few years to more than 10 years. It is concluded that individuals exposed to ultrahigh frequency irradiation have a tendency toward bradycardia and moderate decrease in stroke and volume of the heart. F.O.S.

N69-33730# Royal Aircraft Establishment, Farnborough (England).
THE STIMULUS PARAMETERS OF VESTIBULAR CORIOLIS EFFECTS [DIE REIZPARAMETER DES VESTIBULAREN CORIOLIS-EFFEKTES]

H. Bornschein and G. Schubert May 1969 14 p refs Transl. into ENGLISH from Zschr. fur Biologie (Germany), v. 110, no. 4, Nov. 1958 p 269–275
(RAE-LIB-Trans-1349) Avail: CFSTI

Coriolis-accelerations occur in the system of the semicircular canals under the influence of two rotary movements rotating around a different axis. The stimulating effect depends upon the speed of the two rotations and upon the duration of the simultaneous action. The influence of the three stimulus-parameters mentioned has been tested on guinea-pigs by electronystagmographic experiments. The results are in agreement with the theory developed on the basis of the mechanical properties of the system of semicircular canals. Author

N69-33732# Royal Aircraft Establishment, Farnborough (England).
SOME INVESTIGATIONS INTO THE EFFECTS OF SCOPOLAMINE ON MAN AFTER INGESTION AND AFTER SUBCUTANEOUS INJECTION [NOGLE UNDERSOGELSER OVER SCOPOLAMINS VIRKNINGER PAA MENNESKER VED PERORAL OG SUBCUTAN INDGIFT]
Poul Christiansen May 1969 11 p refs Transl. into ENGLISH from Nord. Med. (Norway), v. 28, no. 4, 1945 p 2372–2374
(RAE-Lib-Trans-1343) Avail: CFSTI

The effects of hyoscine hydrobromide in single doses, given by mouth (3 mg) or by subcutaneous injection (0.5 mg) in a group of 8 subjects are studied. Measurements were made of pupil size, reaction to light and accommodation, salivary flow, pulse rate, respiration, blood pressure, muscle power, skin colour, sweat secretion, rectal temperature and mental effect. A dose of 0.5 mg subcutaneously appeared to be more powerful in its effects than 3 mg given by mouth. Author

N69-33780# Library of Congress, Washington, D.C. Aerospace Technology Div.
MICROBIAL DEGRADATION OF MATERIALS Surveys of Foreign Scientific and Technical Literature
Lee Perkins May 1969 32 p
(AD-687858; ATD-69-41) Avail: CFSTI CSCL 6/6

This compilation of abstracts, obtained from recent Soviet scientific and technical publications, is intended to provide information on Soviet research in biodegradation. The literature search was for articles on the preventive measures taken against microbial degradation of equipment and materials, especially wood, paper, cork, leather, glass, textiles, plant fibers, food, oils (vegetable or animal), adhesives, electronic equipment, or any synthetic substitutes of the above. Author (TAB)

N69-33813# Texas Christian Univ., Fort Worth.
PARAMETERS OF HUMAN PATTERN PERCEPTION Semiannual Progress Report, 18 Sep. 1968 – 18 Mar. 1969
Selby H. Evans 18 Apr. 1969 32 p refs
(Contract DAAD05-68-C-0176)
(AD-687380; SAPR-3) Avail: CFSTI CSCL 5/10

This report is the third six months progress report on a research program titled Parameters of Human Pattern Perception, supported under Project THEMIS. The completion of the initial (methodological) phase of the program is reported; developments in this phase include the achievement of a capability for obtaining quantitative measures on patterns and the completion of research supporting the use and selection of a graded response for pattern identification. Empirical efforts are reported, these being directed primarily at providing a basic understanding of what features people use in pattern recognition tasks and how they use these features. The principal conclusion from these studies is that humans detect and make use of the statistical distributions of features within a set of patterns as a basis for selecting a useful set of features. Theoretical developments relating to computer simulation of human performance in a pattern recognition task are also described. Author (TAB)

N69-33814# Royal Aircraft Establishment, Farnborough (England).
VARIATIONS OF UROPERSINOGEN IN THE FATIGUE SYNDROME. DEVELOPMENT OF THE METHOD OF ANALYSIS [VARIAZIONI DELL'UROPEPSINOGENO NELLA 'SINDROME DA AFFATICAMENTO]
C. Mallino et al Mar. 1969 21 p refs Transl. into ENGLISH from Nuovi Ann. Igiene Microbiol. (Rome), v. 17, no. 1, Feb. 1966 p 31–41
(RAE-Lib-Trans-1333) Avail: CFSTI

To study the changes in the quantity of uropepsinogen emitted daily in subjects working in several installations of the Italian Railway Administration in the frame of the research plan aiming at studying the state of nervous fatigue, an analytical technique by writing in detail the modifications which were made to such a technique, with a view to simplifying its execution was set up. The values obtained in 500 subjects aged between 30–50 years in microgrammes of tyrosine emitted by the enzyme in 100 ml of urine are reported. The data which present the greatest frequency oscillate around the arithmetic average of 62.60 with its relative sigma of ±6.40. Author

N69-33884*# Public Health Service, Phoenix, Ariz. National Communicable Disease Center.
SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS
Martin S. Favero Jul. 1969 16 p
(NASA Order R-137)
(NASA-CR-103791; Rept-26) Avail: CFSTI CSCL 06C

Spores were isolated from space vehicles and tested by a replicate unit system, and the growth progress was reported after two weeks at 32°C. The D_{125C} values were calculated from fractional replicate-unit-negative data using the most probable number technique. Comparisons between this method and the colony count method show no marked differences between the two methods. A third test based on the slope of best fit lines through survivor points show large inconsistencies with the other tests. Attempts are being made to resolve the variations. E.H.W.

N69-33919# National Physical Lab., Teddington (England). Aerodynamics Div.
THE RELATIONSHIPS BETWEEN HEARING LOSS AND NOISE EXPOSURE
D. W. Robinson Jul. 1968 58 p refs
(NPL-AERO-Ac-32) Avail: CFSTI

Measured hearing levels of 759 industrial noise-exposed and of 97 non-exposed control subjects, together with detailed noise measurements and exposure histories of the exposed group, are examined by statistical methods. Subjects were closely screened to exclude cases of hearing impairment other than due to noise and age, the selection criteria being more rigorous than in many other studies. A concise mathematical relationship between the variables is derived, and a nomogram is given for estimating hearing-damage risk in terms of the percentage of people whose noise-induced hearing loss may be expected to exceed any specified audiometric value. The effect of age is allowed for by means of a uniform correction. A random incidence study would in general show greater hearing losses due to causes eliminated from this investigation. The noise exposures ranged from 75 to 120 dB(A) and from 1 month to 50 years. The shape of the noise-induced

component of the audiogram is shown to be independent of the frequency-spectrum of the noise over a wide range of industrially-occurring examples. Author (ESRO

N69-33934# Royal Aircraft Establishment, Farnborough (England).
INFLUENCE OF SOLAR-HEAT LOAD ON MAN [CIEPLNY WPLYW PROMIENIOWANIA SLONECZNEGO NA CZLOWIEKA]
M. Gregorczuk Mar. 1969 16 p refs Transl. into ENGLISH from Przegl. Geofiz. (Poland), no. 2, 1966 p 119–128
(RAE-Lib-Trans-1359) Avail: CFSTI

Some of the thermal effects of sunlight and radiant temperature on man are investigated. Nomograms are presented for calculation of the increase of air temperature equivalent to the solar heat load on man. On the basis of a nomogram for calculation of effective temperature radiation, the influence of radiation on formation of this biometeorological temperature is analyzed. Author

N69-33975*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF MAGNETIC FIELDS UPON BIOLOGICAL SYSTEMS
C. C. Conley, P. W. Droll, W. J. Mills, and Patricia A. Corsaut *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 339–349 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 06S

A space magnetic environment simulation facility was used to observe the effects of both nulled and high magnetic fields on the activities of acid phosphatase, and of two other enzymes, *in vitro*. Results showed the lack of any significant effects by either the high or the low magnetic fields upon all enzyme activities. A biological enzyme content assay on mice cells, placed within the nulled area of the activated coils during the incubation period, markedly reduced cellular enzyme responses to inoculation of a foreign bipolymer, *in vivo*. G.G.

N69-33986# Tufts Univ., Medford, Mass. Neuropsychology Lab.
HUMAN SPATIALLY ORIENTED BEHAVIOR Final Scientific Report, 15 Oct. 1967 – 14 Apr. 1969
Sanford J. Freedman Apr. 1969 8 p refs
(Grant AF-AFOSR-1362-68)
(AD-687847; AFOSR-69-0576TR) Avail: CFSTI CSCL 5/10

Studies of the disruption and relearning of sensorimotor relationships were completed and a theoretical position formulated: (1) Transformations created by perceptual rearrangement and disarrangement experiments change relationships between two or more kinds of spatial information which are normally congruent or concordant. (2) To execute accurate spatially oriented behavior under transformed conditions, the observer must solve the problem of defining the transformation: (a) an adequate amount of relevant information must be available to him and he must be able to assimilate it; (b) information may be supplied through any sensory channel or combination or may derive from memory or cognition; (c) he may be unsuccessful or only partially successful. (3) The problem is solved by inserting into the sensorimotor system a constant which compensates for the experimental transformation. This approach is generally applicable and confers the power of prediction and control whereas other theories which have been proposed do not meet these tests. Author (TAB)

N69-34033# Royal Aircraft Establishment, Farnborough (England).
ON THE PREVENTION OF AIR-SICKNESS IN PILOTS [SULLA PREVENZIONE DEL MAL D'ARIA NEI PILOTI]
C. Borghesan et al. Mar. 1969 28 p refs Transl. into ENGLISH from Riv. Med. Aeron. Spaziale (Rome), no. 29, Dec. 1966 p 374–397
(RAE-Lib-Trans-1348) Avail: CFSTI

The most recent literature on air-sickness pathogenesis is surveyed to arrive at an understanding of the therapeutic utility and efficiency of some drugs, used at present. The results of some tests, (now in use or under study) to be used in screening of non-fit flight individuals because of their predisposition to air-sickness are also examined. This study was carried out to show aviation medicine specialists the methods presently available to prevent a relatively large number of applicant pilots from being disqualified in their advanced flight training. The importance of vestibular proprioceptors was pointed out. The reticular system, at present considered the most important control apparatus of the central nervous system, as well as the conduction and integration center of all sensorial stimuli, was indicated as a pathogenic mechanism center of motion sickness. The results of the treatment with some drugs, as well as of some laboratory methods at present used in the prevention of air-sickness in pilots are also discussed. Author

N69-34044# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.
EFFECT OF RAPID EYE MOVEMENT (DREAMING) SLEEP DEPRIVATION ON RETENTION OF AVOIDANCE LEARNING IN RATS
Chester A. Pearlman Feb. 1969 10 p refs Presented at the Ann. Meeting of the Assoc. for the Psycho-Physiol. Study of Sleep, Denver, 24 Mar. 1968
(AD-687691; SMRL-563) Avail: CFSTI CSCL 5/10

The effect of deprivation of rapid eye movement (REM) sleep upon retention of a passive avoidance response in rats was studied. An incompletely-learned avoidance response was established in one trial by shocking the animals when they stepped down from an elevated platform. Fourteen animals were then deprived of REM sleep by placing them on small inverted pots in a pool of water. Twelve control animals were placed on slightly larger pots which permitted normal sleep. None of the REM-Deprived animals showed retention of the response when tested the day after training, whereas sixty per cent of the control animals showed retention. The results suggested that REM sleep is essential for adequate adaptation to new experiences, especially those which cannot be completely comprehended upon first exposure. Author (TAB)

N69-34073# Western Australia Univ., Nedlands. Dept. of Psychology.
A SYSTEMATIC INVESTIGATION OF CONTRAST EFFECTS AND SIMILAR PHENOMENA RELATED TO VIGILANCE TASKS Final Technical Report
Vincent Di Lollo Mar. 1969 11 p refs
(Grant AF-AFOSR-968-67)
(AD-687446; AFOSR-69-1215TR) Avail: CFSTI CSCL 5/10

The report is a summary of research in four major areas: Contrast effects in psychophysical judgment; Contrast effects in the single runway; Frustration effect in the double runway; and Appetitive classical conditioning of the rabbits jaw movement. The results obtained in each area are presented with reference to detailed reports submitted during the period of investigation. Author (TAB)

N69-34082# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
BIBLIOGRAPHIC DISCUSSION ON THE PHYSICO-CHEMICAL BEHAVIOR AND THE RADIOECOLOGY IN HYDROBIOLOGICAL SYSTEMS OF CERIUM AND OTHER

LANTHANIDES [DISCUSSION BIBLIOGRAPHIQUE SUR LE COMPORTEMENT PHYSICO-CHIMIQUE ET LA RADIOECOLOGIE DANS LES SYSTEMES HYDROBIOLOGIQUES DU CERIUM ET DE QUELQUES AUTRES LANTHANIDES]

Robert Bittel May 1969 30 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-PSAF-003-63-10)
(CEA-BIB-138; EUR-4107-f) Avail: CFSTI

This report forms part of the studies on the behavior of radionuclides characterized by a complex physico-chemistry and whose destiny in hydrobiological systems varies according to the combinations in which they are included. The first part is dedicated to the physico-chemical aspects and the main characteristics of rare earths are examined. Emphasis was given to the lanthanides, certain isotopes of which are fission products with long or medium half-lives, and more particularly to cerium, prometheum and europium. The complexes of these elements with different mineral or organic compounds, present in effluents and contaminated aqueous environment, have been examined with special regard to compounds of biochemical importance. Special attention has been given to the analytical techniques used in tracer chemistry and radiochemistry. The second part is dedicated to the behavior of rare earths, principally cerium in water and soils which depend at the same time on the physico-chemical nature of the radioelement and on the environmental conditions. For the rare earths as for ruthenium and cobalt, it seems desirable to substitute the idea of the radioecology of a physico-chemical combination to that of the radioecology of a radionuclide. Author (ESRO)

N69-34150# United Kingdom Atomic Energy Authority, Harwell (England).

UK MEASUREMENTS AT THE 5TH INTERNATIONAL INTERCOMPARISON OF NUCLEAR ACCIDENT DOSIMETRY SYSTEMS, ORNL, JULY 1968

N. Adams and J. A. Dennis Jan. 1969 35 p refs
(AERE-R-6008) Avail: CFSTI

In a series of exposures to mixed neutron and gamma fields produced by the Health Physics Research Reactor at ORNL, teams from several countries compared their systems for assessing doses in criticality accidents. The measurements made by the Harwell team, both in free-air and on phantoms, with A.E.R.E. criticality dosimeters and a threshold detector system are given. These measurements are compared with those made by the other teams. The sodium activation in 18 cm diameter cylindrical phantoms was found to be very nearly the same as in man-like phantoms. The use of such phantoms in installed dosimetry systems is recommended. Conceptual inadequacies of the assessment of intermediate-energy neutron doses from threshold detector systems are briefly discussed, and more work on this problem is recommended. Author (NSA)

N69-34204# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.

THE RADIOSENSITIVITY OF THE SWISS-RAP MOUSE AS A FUNCTION OF ITS GROWTH RATE [RADIOSENSIBILITE DE LA SOUCHE DE SOURIS SWISS-RAP EN FONCTION DE SON TAUX DE CROISSANCE]

Gérard Legeay and Jean-Francois Glas Apr. 1969 19 p refs In FRENCH; ENGLISH summary
(CEA-R-3797) Avail: CFSTI

The results of an exhaustive study of the age-dependence of the radiosensitivity of female Swiss-Rap mice are given. A close relationship between radiosensitivity and age was not apparent, whereas the weekly growth rate could be accurately related to radiosensitivity. Thus the latter quantity should be studied when a strain is to be used for biological experiments. Author (ESRO)

N69-34221# Sharpley Labs., Inc., Fredericksburg, Va.

DETECTION OF MICROBIAL CONTAMINANTS IN SPACE SYSTEM WATER SUPPLIES Final Report, Apr. 1967-Jun. 1968

J. Miles Sharpley Wright-Patterson AFB, Ohio AMRL Dec. 1968 71 p refs
(Contract F33615-67-C-1597)
(AD-687853; AMRL-TR-68-87) Avail: CFSTI CSCL 13/2

The feasibility of detecting microorganisms in water by using declining flow rates through a membrane filter has been determined. Results obtained indicate that microorganisms in water may be detected by the decrease in flow rates through a sub-micron filter used under standard conditions. Decreases in flow rates shown by bacteria are appreciably greater than those caused by inert materials. Results from this study indicate that differential filtration rates may be used as a device for the physical detection of microorganisms in potable water in space system water supplies. Author (TAB)

N69-34228# Army Foreign Science and Technology Center, Washington, D.C.

MAN IN SPACE. SCIENTIFIC POPULAR MEDICAL LITERATURE

A. M. Genin et al Apr. 1969 102 p refs Transl. into ENGLISH of the book "Chelovek v Kosmose" USSR, 1967 p 1-159
(AD-687760; FSTC-HT-23-900-68) Avail: CFSTI CSCL 6/19

The booklet introduces certain information concerned with the preparation and realization of manned space flights on board the Vostok spacecraft. The work is designed for a wide range of readers. Author (TAB)

N69-34243# Texas Univ., Houston. Graduate School of Biomedical Sciences.

THE EFFECTS OF LASER RADIATION ON RECEPTOR FUNCTION IN HUMAN AND PRIMATE EYES

H. G. Sperling, R. S. Harwerth, J. H. Mabry, and D. J. Landa Apr. 1969 26 p refs
(Contract DADA17-67-C-7154)
(AD-688626; UT-GSBS-DADA-2) Avail: CFSTI CSCL 6/5

In a series of experiments, the effects of intense spectral bands having the characteristics of ruby and argon laser light have been measured in rhesus monkey eyes. Results obtained by measuring spectral sensitivity in their presence - or immediately after these exposures - demand a two-stage (receptor stage, neural opponent stage) explanation of spectral sensitivity for the highly light adapted eye. In continuing studies, these measures are being carried over the entire range up to intensities of laser light which will produce gross thermal injury. It is planned to relate changes in visual sensitivity to ultrastructural changes in the retina. Techniques for ultrastructural study of the vertebrate retina are briefly discussed. Author (TAB)

N69-34250# School of Aerospace Medicine, Brooks AFB, Tex.

BIOASTRONAUTICS AND THE EXPLORATION OF SPACE

Charles H. Roadman, Hubertus Strughold, Roland B. Michell, Jack Harmon, and Richard Schafer Nov. 1968 633 p refs Presented at the 4th Intern. Symp., San Antonio, Tex., 24-27 Jun. 1968
(AD-687893) Avail: CFSTI CSCL 6/3

Contents include: History and tribute to aerospace medical pioneers; On fundamental scientific advances resulting from the space program; Some remarks on the evolution of the atmosphere and the oceans; Chemical evolution and the origin of life; Physics of the universe; The Andean man; Supersonic and hypersonic flight; Life support (survival) in space; One-man propulsion devices and their application on earth and in space; Manned space stations; Bioastronautics and orbiting space stations; Orbital flight results; Geologic orbital photography; Conditions on the planet Venus; The

sun; Empirical arguments concerning Dirac's gravitational hypothesis; A strategic approach to interplanetary flight; The human eye in space exploration; Biodynamic environments in spaceflight; Nutrition for long space voyages; Space chemistry in the 1970s; Bionics; Planetary environmental medicine (Mars); Next--The Planets; Importance of the use of extraterrestrial resources to the economy of space flight beyond near-earth orbit; Problems in detection of extraterrestrial life; Extraterrestrial biology. TAB

N69-34314*# West Virginia Univ., Morgantown. Dept. of Microbiology.
RELATIONSHIP OF OXYGEN TENSION TO VIRAL DISEASE Final Report
B. E. Kirk 2 Jun. 1969 14 p refs
(Grant NGL-49-001-001)
(NASA-CR-103947) Avail: CFSTI CSCL 06M

Attempts are described to develop a tissue culture system useful for isolation and quantization of lymphocytic choriomeningitis virus. Using a number of different types of cell cultures, culture conditions were manipulated in attempts to induce a direct cytopathic effect by the virus which might be used as an index of infection. These attempts have been based on reports of other investigators regarding similar effects with the same or different viruses as well as leads obtained in experiments. Results obtained to date are presented according to the type of cell used; they include chick embryo cells, rabbit embryo cells, mouse embryo cells, monkey kidney cells, mouse peritoneal macrophages, and BHK-21 clone 13 cells. Concentrations, inhibitors, serums, and antigens were also studied. Author

N69-34457# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE MEASUREMENT OF HUMAN PILOT DYNAMICS IN A PURSUIT-PLUS-DISTURBANCE TRACKING TASK Interim Report
L. D. Reid Apr. 1969 192 p refs
(Grant AF-AFOSR-1490-68)
(AD-688505; UTIAS-138; AFOSR-69-1431TR) Avail: CFSTI CSCL 5/10

The report gives a detailed description of the theory required to measure for human pilot performing compensatory and pursuit-plus-disturbance tracking tasks with continuous input spectra. A group of 8 subjects performed over 4000 individual tracking tasks in a period of 2 years as part of a program to investigate mathematical models of this task. The results of the study are presented as amplitude and phase plots of measured describing functions, (two describing functions are used to model the pursuit-plus-disturbance cases). Linear models were fitted to the measured data and used to determine quantitative trends among the tasks performed. Author (TAB)

N69-34488# School of Aerospace Medicine, Brooks AFB, Tex.
PHARMACOLOGY AND TOXICOLOGY OF PROPELLANT HYDRAZINES
Dale A. Clark, Jarrell D. Bairrington, Harold L. Bitter, Frederic L. Coe, and Miguel A. Medina Dec. 1968 131 p refs
(AD-688500; SAM-REVIEW-11-68; SAM-TR-68-125) Avail: CFSTI CSCL 21/8.1

This review surveys the toxicology, metabolic effects, central nervous system effects, renal aspects, effects upon the fibrinolytic system and biologic membranes of the propellant hydrazines, hydrazine, monomethylhydrazine, and unsymmetrical dimethylhydrazine. Author (TAB)

N69-34586# Joint Publications Research Service, Washington, D.C.
BIOMEDICAL RESEARCH CONDUCTED IN THE USSR DURING 1968 AND EARLY 1969 UNDER THE SPACE RESEARCH PROGRAM
V. V. Parin et al 1 Aug. 1969 13 p refs Transl. into ENGLISH of the publ. "Mediko-Biologicheskiye Issledovaniya, Provedennyye v SSSR v Techeniye 1969 g. i Nachala 1969 po Programme Issledovaniya i Osvoyeniya Kosmicheskogo Prostranstva" Moscow, Izd. AN SSSR, 1969 p 1-19
(JPRS-48534) Avail: CFSTI CSCL 06S

Validation of the admissible doses and the protection of spacecrews against exposure to ionizing radiation were studied by exposing dogs to gamma irradiation over a period of several years. The clinical results obtained during observations of the animals over the last two years of the experiment in hematology, biochemistry physiology, cytology, and immunology are given. The recommended doses for a 30 day space flight are: (1) admissible dose, 15 rem; (2) justifiable risk dose, 50 rem; and (3) critical dose, 125 rem. Daily diuresis of cosmonauts for pre- and postflight periods are tabulated. F.O.S.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N69-33241# Explosives Research and Development Establishment, Waltham Abbey (England).
THE TESTING OF SAFETY SPECTACLES, LENSES, GOGGLES AND VISORS, PART 2
L. D. Cole and R. Pape Oct. 1968 43 p refs
(AD-687224; ERDE-10/M/68) Avail: CFSTI CSCL 6/17

Fifteen types of spectacles, goggles and visors have been tested for resistance to glass fragments driven by explosive charges, six types to the explosion of bare detonators and six types to glass flasks burst by nitrogen pressure. TAB

N69-33260*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A REVIEW OF SPACECRAFT WASTE-MANAGEMENT SYSTEMS
W. W. Kemmerer, Jr. and Jon W. Morar Washington Aug. 1969 14 p
(NASA-TM-X-1851) Avail: CFSTI CSCL 05E

This document reviews the design requirements, development, and use of the waste-management systems for Project Mercury and for the Gemini Program. A review of the use of these systems during actual missions is included. Author

N69-33761*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
PLANETARY QUARANTINE PROGRAM Quarterly Progress Report for Period Ending 30 Jun. 1969
30 Jun. 1969 42 p refs Supported in part by AEC
(NASA Order R-09-019-040; NASA Order W-12853)
(NASA-CR-103823; QR-13) Avail: CFSTI CSCL 05E

A planetary quarantine computer system for lunar programs was rendered in a reduced version, porgrammed, and checked out. Work on a kinetic death sterilization model for spore heat inactivation is described. Another model study dealt with the

quantification of qualitative microbial sampling. Procedures, materials, and a microscopic particle counter were examined for use in bioburden experiments and modeling. In a thermo-radiation sterilization study, the complementary effects of simultaneous gamma radiation and heat were determined on various spores and on *Streptococcus faecium*. An estimate was completed of the transfer of microorganisms from the surface of the Apollo spacecraft-lunar module adaptor to the lunar module during launch. K.W.

N69-33775*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CLEAN ROOM TECHNOLOGY

James W. Useller Washington 1969 66 p refs

(NASA-SP-5074) Avail: SOD $0.35; CFSTI CSCL 06L

The clean room requirements are studied to control contamination for component reliability in industry and the space program. Contaminants are classified in four general categories: (1) particulate: dust, chips, fibers, etc.; (2) chemical: gases, liquids, oily films, etc.; (3) biological: bacteria, virus, fungi, spores, etc.; and (4) energy or changes of state. The controlling factors for clean rooms are facility design, equipment, procedures, activities, and maintenance. The operation and monitoring procedures are discussed. F.O.S.

N69-33837# General Dynamics Corp., Groton, Conn. Electric Boat Div.

EXPERIMENTAL INVESTIGATIONS OF MAN-MACHINE PROCESSING OF INFORMATION, VOLUME 3 Annual Report, Jul. 1967 - Jul. 1968

Taylor L. Booth, Herbert M. Kaufman, Jerry Lamb, Robert M. Levy, and Russell A. Reiss Oct. 1968 153 p refs

(Contract Nonr-2512(00))

(AD-684838; U417-68-098) Avail: CFSTI CSCL 17/1

The aim of this project is to provide basic knowledge of the methods which may be used by a man-computer system to detect the presence of a target, using data from a passive sonar receiver. This research consists of analytical studies to evaluate important system parameters and experimental investigations measuring operator performance under various operating conditions. The first two reports in this volume describe the effects of pattern variations on human pattern recognition. The results measured the operators ability to visually detect patterns differing in shape and to detect patterns generated by statistically dependent sequences. The second two reports deal with basic human information processing and describe the testing of a predictive model for reaction time to visual stimuli and a test of the effects of number of stimuli on memory span. Author (TAB)

N69-33932# Flying Personnel Research Committee, London (England).

A PERSONAL TORSO PARACHUTE HARNESS AND A MODIFIED RESTRAINT HARNESS FOR THE TYPE 9 EJECTION SEAT

D. G. Beeton, R. Harrison, J. H. Lamon, A. T. Prescott, C. Reader et al Dec. 1968 34 p refs

(FPRC/Memo-244) Avail: CFSTI

A personal torso parachute harness and a modified restraint harness have been evaluated and compared with the parachute and restraint harness proposed for the Martin Baker type 9 ejection seat. Experiments involving high vertical and forward accelerations have shown that the personal torso harness and the modified restraint harness are suitable alternatives to the proposed assembly and avoid the risk of restriction of the control column movement and fouling of the lap strap/pilot's equipment connector, in the Harrier aircraft. Recommendations are made to improve the inadequate shoulder restraint of the type 9 ejection seat. Author

N69-34083# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

AN AUTOMATIC ANALOG BREATHING SYSTEM FOR MULTICELL PRESSURE SUITS Final Report

Otto Schueller Mar. 1969 21 p refs

(AD-687436; AMRL-TR-67-235) Avail: CFSTI CSCL 6/17

The design criteria for an oxygen regulator for multicell pressure suits, such as the Boyles Law Suit, are analyzed. On the latest models of the Boyles Law Suit the conventional breathing bladder in the thorax area was omitted to reduce vulnerability and fire hazard. The volume changes of the body during breathing are compensated by equivalent volume changes of the gas in the closed cells of the suit. If a conventional oxygen regulator is used, the wearer must work to compress the gas in the closed cells. An oxygen regulator is proposed that uses the energy stored in compressed oxygen to do the necessary compression work on the gas in the closed cells of the suit, and to relieve the wearer from fatiguing breathing effort. A pressure sensor in the chest area or the slight pressure fluctuations during breathing can be used to produce simultaneous breathing pressure changes equivalent or approximate to the gas pressure changes in the closed cells or tubes of the suit. This type of regulator also permits considerable reduction of the cell volume and bulk of the suit. Author (TAB)

N69-34246*# TRW Systems, Cleveland, Ohio. Mechanical Products Div.

LONG-TERM OPERATION OF A WATER ELECTROLYSIS MODULE

F. H. Schubert [1969] 25 p refs

(Contract NAS2-4444)

(NASA-CR-73365) Avail: CFSTI CSCL 06K

A water electrolysis module (WEM) designed to provide 3.6 pounds of oxygen per day at a current density of 100 amps/ft^2 and at a pressure level of 80 psia was developed. Although designed for aircraft application, the concepts employed in the design of the module make its use in other life support systems possible. One of the ten-cell water electrolysis modules fabricated, and designated as WEM #1, has been successfully operated for 7,525 hours. These hours consist of 300 hours of parametric, 180 hours of cyclic, and 7,045 hours of endurance testing, to date. The endurance test program is being conducted at a current density of 80 amps/ft^2, a temperature of 175°F, and a pressure level of 30 psia. A description is given of the cell and module configurations and the materials of construction selected. Results of the parametric and cyclic test programs are presented and cell performance and servicing and maintenance requirements discussed. Author

N69-34296# Air Force Systems Command, Wright-Patterson AFB, Ohio. Human Resources Lab.

APPLICATIONS OF A SIMULATION ANALYZER PROGRAM FOR DERIVING AND EVALUATING NUMERICAL INTEGRATION TECHNIQUES Technical Report, Jan.-Aug. 1968

Patricia A. Knoop Mar. 1969 118 p refs

(AD-687854; AFHRL-TR-68-9) Avail: CFSTI CSCL 9/2

The report describes applications of a Simulation Analyzer Program for deriving or evaluating numerical integration methods for use in flight simulation for training. The FORTRAN program was developed in an earlier study, and its theoretical bases and capabilities are briefly presented in this report. The program is used to derive and evaluate optimal integration methods for application to a selected first-order and a second-order differential system. The derived methods are used to solve these systems, and actual solution characteristics are compared with those predicted beforehand by the program. Characteristics of accuracy, actual percent error, stability, and error propagation are shown to be accurately predicted, as is the largest integration interval usable for each problem with each integration method. A thorough description is

provided of the five popular simulation-integration techniques in use today and of a recommended procedure for using the Simulation Analyzer Program to derive new integration methods which allow maximization of the integration interval for specific simulation problems. As an example, the program is used to evaluate known methods and derive new methods for the F-100A problem using integration intervals of 0.05 and 0.10. A list of over 70 new integration methods derived by the program, including their stability and truncation-error characteristics, is provided. Author (TAB)

N69-34393# Aerojet General Corp., Azusa, Calif. Electronics Div.

CRYOGENIC SOLID OXYGEN STORAGE AND SUBLIMATION INVESTIGATION Final Report, 1 Jul. 1967–31 Mar. 1968

John E. Ahern and Truman W. Lawson, Jr. Wright-Patterson AFB, Ohio AMRL Aerospace Med. Res. Lab. 185 p refs (Contract F33615-67-C-1849)

(AD-687852; AGC-3545; AMRL-TR-68-105) Avail: CFSTI CSCL 6/11

The use of solid oxygen for storage and supply systems in space applications was studied both analytically and experimentally. The analysis indicated that the use of solid oxygen could provide substantially longer storage times over that obtainable with subcritical and supercritical oxygen. Oxygen transport from the vacuum storage condition of solid oxygen to a condition suitable for breathing was demonstrated experimentally by two methods, vapor transport using cryosorption pumps and solid transport by mechanically moving the solid through a vapor lock. A preliminary analysis of the transport methods indicates that the mechanical system should be the most suitable. Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-33243# Army Weapons Command, Rock Island, Ill. Science and Technology Lab.

COMPUTER PROGRAM FOR THE DERJAGUIN-LANDAU-VERWEY-OVERBEEK THEORY OF COLLOID STABILITY

Thomas P. Miller Mar. 1969 20 p refs

(AD-687256; RIA-69-587) Avail: CFSTI CSCL 7/4

A Fortran program was developed to determine the surface potential required to give a total potential energy of interaction sufficient to insure colloid stability. The program eliminates the tedious calculations inherent in the Derjaguin-Landau-Verwey-Overbeek theory of colloid stability. The programs general format offers a wide range for acceptable input and is readily adapted to solving other problems associated with colloid stability. Author (TAB)

N69-33245# Ballistic Research Labs., Aberdeen Proving Ground Md.

THE EFFECT OF PRESSURE ON THE CHEMILUMINESCENT SPECTRUM OF OXYGEN ATOMS AND NITRIC OXIDE

Eli Freedman and John R. Kelso Mar. 1969 27 p refs

(AD-687268; BRL-1430) Avail: CFSTI CSCL 7/2

As another approach to establishing the mechanism of the chemiluminescent reaction between oxygen atoms and nitric oxide, the effect of pressure on the spectrum has been investigated. The oxygen atoms were generated by a microwave discharge, and mixed with nitric oxide in a two-stage system where the pressure could be varied from 1.0 to 0.005 torr. Spectra obtained at pressures below 0.5 torr all show a shift towards the blue; the magnitude of the shift is roughly proportional to the decrease in pressure below 0.5 torr. This shift is almost identical with that observed in the fluorescence of NO2. Adding either argon or sulfur hexafluoride to the mixture at low pressures does not change the spectrum but at around 1 torr, SF6 causes a shift similar to a decrease in pressure. These results are shown to be consistent with a multi-step mechanism involving the formation, stabilization, quenching, and vibrational de-excitation of one excited electronic state. Author (TAB)

N69-33246# Ballistic Research Labs., Aberdeen Proving Ground, Md.

EXPLOSIVE REACTIONS OF N-F COMPOUNDS WITH HYDROGEN

Lester P. Kuhn and Carl R. Wellman Apr. 1969 30 p refs

(AD-687266; BRL-1431) Avail: CFSTI CSCL 7/2

In order to gain an understanding of the explosive reactions of N-F compounds, a study has been made of the explosive reaction between tetrafluorohydrazine and hydrogen. The explosion is inhibited by substances capable of destroying hydrogen atoms. Tetramethylethylene is the most effective inhibitor of the substances tested. One part of this substance in 10,000 parts of reaction mixture completely suppresses the explosion. The reaction has the properties of a chain reaction initiated by the difluoroamino radical and having hydrogen atoms as one of the chain carriers. The stoichiometry and the products of the reaction depend in an unusual manner upon the presence of inert gas. Mechanisms are proposed for these reactions which are consistent with the experimental data. The intermediates, N2F3 and N2F2, which are believed to be formed in the reaction can react in different ways depending upon the relative abundance of the reactants and upon explosion temperature thus accounting for the peculiar features of this system. Author (TAB)

N69-33248# Explosives Research and Development Establishment, Waltham Abbey (England).

THE NMR SPECTRA OF NITRATE ESTERS

R. T. M. Fraser Dec. 1968 16 p refs

(AD-687225; ERDE-22/M/68) Avail: CFSTI CSCL 7/4

The 1H spectra of twenty-one nitrate esters have been measured. These were the higher alkyl nitrates, from n-propyl to n-decyl nitrate, as well as iso-propyl and iso-butyl nitrates; ethylene, tri-, tetra-, and pentamethylene dinitrates; 2,2-oxydiethyl dinitrate (diethylene glycol dinitrate); glycerol 1,3-dinitrate; 2-chlorotrimethylene dinitrate; meso-1,2-dimethylethylene dinitrate and glycerol 1,2,3- and butane 1,2,4-triyl trinitrates. A complete analysis of the spectrum was not possible for any of the compounds; a number, like the corresponding fluorides, give deceptively simple spectra. In others the resolution is not sufficient to allow all the NMR parameters to be evaluated. A brief discussion of the parameters which were obtained, and their use in the analysis of mixtures is given. Author (TAB)

N69-33261# Frankford Arsenal, Philadelphia, Pa. Quality Assurance Directorate.

APPLICATION OF INFRARED SPECTROSCOPY TO THE ANALYSIS OF INORGANIC NITRATES. PHASE 2: SPECTRA OF INORGANIC NITRATES IN THE SOLID STATE; QUANTITATIVE DETERMINATION OF INORGANIC NITRATES BY THE PELLET TECHNIQUE

David E. Chasan and George Norwitz Mar. 1969 45 p refs
(AD-687274; FA-T69-3-1) Avail: CFSTI CSCL 7/4

A comprehensive survey was made of the spectra of inorganic nitrates in the solid state (pellet or mull technique). The spectra of 77 inorganic nitrates are listed in tabular form and are divided into the following four groups: anhydrous ionic nitrates, anhydrous covalent nitrates, hydrated ionic nitrates, and hydrated covalent nitrates. The type of covalent bonding and methods of preparation used for the anhydrous nitrates are given. The application of the infrared data to the quantitative determination of inorganic nitrates by the pellet technique was investigated. Methods are proposed for the determination of four important inorganic nitrates (sodium, potassium, barium, and strontium nitrates) that are of interest to Ordnance. Methods are also proposed for the determination of two nitrates in the presence of each other. Author (TAB)

N69-33256# Picatinny Arsenal, Dover, N.J.
THE KINETICS OF THE REACTION OF LITHIUM CHLORIDE AND LEAD AZIDE EXPOSED TO THE ATMOSPHERE
Henry Kramer Apr. 1969 20 p refs
(AD-687281; PA-TR-3842) Avail: CFSTI CSCL 7/2

This preliminary report demonstrates that the lead azide-lithium chloride system can be treated kinatically. The study shows the optimum composition of lead azide and lithium chloride, and suggests means of accelerating the destruction of the lead azide. The data which is suspect in the calculation appears to be (1) the solubility product of lead azide, (2) the solubility product of Pb(OH)N3, and (3) the distribution coefficient of hydrazoic acid between air and water as a function of temperature. Author (TAB)

N69-33259*# United Aircraft Corp., East Hartford, Conn. Research Labs.
ANALYTICAL STUDY OF CATALYTIC REACTORS FOR HYDRAZINE DECOMPOSITION Annual Progress Report
Arthur S. Kesten May 1969 66 p
(Contract NAS7-458)
(NASA-CR-103815; UARL-HB10461-38; APR-3) Avail: CFSTI CSCL 07D

Analytical studies of catalyzed hydrazine decomposition reaction chambers were performed in order to establish procedures capable of predicting the effects of pulse operation of the reactor for an arbitrary duty cycle on the transient behavior of the system. These studies included an extension of a computer program previously developed to calculate temperature and reactant concentrations as functions of time and axial position in typical reaction chamber configurations. The extended program includes consideration of the effects of heat conduction and diffusion when flow is stopped. In addition, reaction chamber fluid dynamics are taken into account by allowing for feed pressure and mass flow rate changes with time. The effects of these changes on thermal and catalytic decomposition of reactants, along with heat and mass transfer between the free-gas phase and the gas within the pores of the catalyst pellets, are considered. Author

N69-33349*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BIOLUMINESCENT ASSAY TECHNIQUE FOR FLAVIN COENZYMES
Emmett W. Chappelle, inventor (to NASA) and Grace L. Picciolo, inventor (to NASA) Filed 5 May 1969 18 p
(NASA-Case-GSC-10565-1; US-Patent-Appl-SN-822039) Avail: CFSTI CSCL 07C

A rapid assay technique for the determination of flavin coenzymes has been developed using a bacterial bioluminescent reaction. The flavin values are freed by boiling with perchloric acid to rupture the cells and hydrolyze flavin adenine dinucleotide to flavin mononucleotide (FMN). A base stabilized sodium borohydride reduction of FMN is catalyzed by palladium chloride and the reduced flavin mononucleotide ($FMN-H_2$) is reacted with the enzyme luciferase to produce light in an intensity directly proportional to the flavin concentration. The process provides exceptional specificity and sensitivity, should prove of value in metabolic research, and can be adapted for use in an unmanned spacecraft in an extraterrestrial life detection system. NASA

N69-33362*# Radio Corp. of America, Princeton, N.J.
ELECTRONICALLY TUNED OPTICAL FILTERS
Joseph P. Castellano, George H. Heilmaier, Edward F. Pasierb, Jr., and Michael T. McCaffrey Apr. 1969 61 p refs
(Contract NAS12-638)
(NASA-CR-88198) Avail: CFSTI CSCL 07D

The cooperative alignment of a nematic liquid crystal in an electric field is used to orient guest pleochroic dye molecules (molecules whose absorption spectrum is a function of their molecular orientation with respect to the polarization of the incident light). Electronic color switching at room temperature was achieved using fields of the order of 10 kV/cm (dc through audio) at powers of approximately 1 mW/cm^2 with a variety of dye structures. The preparation of dichromic optical filter was achieved using mixtures of a photochromic, pleochroic dye in a nematic host. Polychromic optical filters were prepared using layers of yellow and cyan guest-host systems. Rise times of 1 to 5 msec and relaxation times of 30 to 200 msec were obtained. Dielectric dispersion measurements showed that approximately 1100 molecules of the nematic host material act collectively upon electronic excitation. Author

N69-33371*# Drexel Inst. of Tech., Philadelphia, Pa. Dept. of Chemistry.
MECHANISMS FOR THE EFFECT OF ELECTRIC AND MAGNETIC FIELDS ON BIOLOGICAL SYSTEMS Semiannual Status Report, Jan. 1969–Jun. 1969
H. Baessler, T. M. Laronge, and M. M. Labes Jun. 1969 37 p refs
(Grant NGR-39-004-015)
(NASA-CR-103705; SASR-4) Avail: CFSTI CSCL 07C

Measurements of dielectric constants of a cholesteryl chloride–cholesteryl myristate mixture having a strongly temperature dependent helical pitch have been performed in the presence and absence of an applied dc electric field. An analysis of the molecular arrangement in samples oriented by wall effects is presented, as well as the perturbations in this arrangement which occur both thermally and by the application of an electric field. Elastic moduli of bending and torsional strain are estimated from the threshold electric fields observed to (1) induce helical perturbation and (2) destroy the helical structure in the transition of a nematic phase. Author

N69-33399# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
ON THE SYNTHESIS AND PROPERTIES OF HYDRAZINIUM (1 PLUS) FLUORIDE
P. Glavic and J. Slivnik Feb. 1969 11 p Presented at the 2nd European Symp. on Fluorine Chem., Gottingen, West Germany, 28–31 Aug. 1968
(NIJS-R-555) Avail: CFSTI

The formation of hydrazinium (1+) fluoride in water solutions is reported as well as the isolation of the solid compound. Conductometric analysis and calorimetry were used simultaneously with the preperation work in order to determine the formation conditions of hydrazinium (1+) fluoride. Some physical and chemical properties of the solid hydrazinium (1+) fluoride and its water solutions such as density, solubility in various solvents, heats of neutralization, and heats of solution are given. The differential

thermal analysis of this compound was carried out and the results were compared with the melting point determinations. The unit cell of the compound is given and the infrared spectrum (from 4000 to 40 cm^{-1}) is discussed with regard to the spectra of the other hydrazinium halides. Author

N69-33476*# Rensselaer Polytechnic Inst., Troy, N.Y.
A STUDY OF THE EFFECT OF SURFACES ON OXYGEN ATOM RECOMBINATION AT LOW PRESSURES Technical Status Report, 1 Nov. 1968–30 Apr. 1969
P. Harteck, R. R. Reeves, Jr., K. Loomis, and A. S. Bergendahl 30 Apr. 1969 21 p refs
(Grant NGR-33-018-086; RPI Proj. 441.22)
(NASA-CR-103836; SASR-4) Avail: CFSTI CSCL 07D

Equipment was designed, built, and operated over the last two years simulating satellite environment for the study of the effect of surfaces interacting with O-atoms. The most pertinent metals from the standpoint of current use (silver, titanium, gold and stainless steel) were tested. The results show that these are not good metals for fabrication under many conditions of satellite mass spectrometric measurements. These results are basically in accord with the observed satellite measurements. A modified system is now operable for rapid testing of additional promising materials. It is planned to obtain additional results with mixtures of oxygen and H-atoms as atomic hydrogen is also a constituent of our rarefied upper atmosphere. Author

N69-33493*# Avco Corp., Lowell, Mass.
STUDY OF FERROMAGNETIC LIQUID
Robert Kaiser and Ronald E. Rosensweig Washington NASA Aug. 1969 100 p refs
(Contract NASw-1581)
(NASA-CR-1407) Avail: CFSTI CSCL 07D

It is possible to induce substantial magnetic forces in ferrofluids. These are stable micro-dispersions formed by grinding a ferromagnetic powder in the presence of a surfactant solution. Novel hydrocarbon base ferrofluids with increased magnetization and improved thermal stability have been prepared. Water, fluorocarbon and nonvolatile ester base ferrofluids have also been synthesized. Physical properties of numerous magnetite base ferrofluids were measured. For these systems the particle size is less than 150 Å. Magnetic properties can be accounted for by superparamagnetic theory and particle concentration. The maximum attainable concentration of particles varies as a function of the ratio of the stabilizing layer thickness to the particle diameter. A minimum value of 30 Å was observed. Ferrofluid viscosity increases as a function of carrier liquid viscosity, particle concentration, and the stabilization ratio. Author

N69-33495*# Brigham Young Univ., Provo, Utah.
STUDIES OF REACTION GEOMETRY IN OXIDATION AND REDUCTION OF THE ALKALINE SILVER ELECTRODE Quarterly Report
Eliot A. Butler and Angus U. Blackham 15 May 1969 43 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952268)
(NASA-CR-103848; QR-4) Avail: CFSTI CSCL 07D

Cyclic current step measurements during the $Ag-Ag_2O$ oxidation plateau were made. The results of measurements are very similar to those obtained from systems $(Ag-Ag(NH_3)_2^{+})$, $(Fe^{+2}-Fe^{+3})$ where the overvoltage is dependent on diffusion of an electroactive species to the surface of an electrode. The exchange current density, i_o, decreases from 1.44 ma/cm^2 to 0.75 ma/cm^2 along the $Ag-Ag_2O$ plateau. The changes in the ohmic resistance of the silver oxide film formed in 0.0543, 0.109, 1.09, 5.43, and 10.9 F KOH were measured. The maximum resistance of the oxide measured in these electrolytes was 0.31, 0.28, 2.44, 5.15, and 0.16 Ωcm^2. Evidence for a proposed explanation of the changes which occur in the oxide film resistance is presented. Experiments were performed which show that two reduction reactions, $AgO-Ag_2O$ and Ag_2O-Ag, proceed simultaneously at about equal rates during the first reduction plateau until all of the AgO is reduced. Author

N69-33498*# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF BATTERY SEPARATOR MATERIAL PROCESS Interim Report
L. M. Adams and W. W. Harlowe, Jr. 29 May 1969 95 p Prepared for JPL
(Contracts NAS7-100; JPL-951718; SwRI Proj. 01-2015)
(NASA-CR-103838) Avail: CFSTI CSCL 07D

The dose rate and total dose for irradiation grafting of polyethylene film with acrylic acid were standardized at 0.012 Mrad/hr and 0.815 Mrad, respectively. High carbon tetrachloride (chain terminator) concentrations in the acrylic acid grafting solution cause a decrease in uniformity of the properties of battery separator material on sterilization. Of the chain terminators evaluated, carbon tetrachloride, acetone, sulfur, and carbon disulfide appear to be the most satisfactory. The replacement of benzene in the grafting solution with toluene or xylene results in poorly grafted films. Polyethylene film can be grafted with acrylic acid using aqueous grafting solutions if a gelation inhibitor is employed. Polyethylene film was grafted in 600-foot lengths. However, 100-foot lengths are more convenient to handle in the laboratory. The temperature during neutralization and washing has an effect on the properties of acrylic acid grafted polyethylene film. On treatment at 97°C, the product has a lower electrical resistance than when treated at 80°C. Author

N69-33526*# Thermo Electron Corp., Waltham, Mass.
APPLIED THERMIONIC RESEARCH Final Report, 1 Dec. 1967–1 Dec. 1968
E. P. Gyftopoulos, G. N. Hatsopoulos, D. Lieb, F. Rufeh, M. Shaw et al 1 Dec. 1968 230 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952184)
(NASA-CR-103852; TE4092/3-108-69) Avail: CFSTI CSCL 07D

A modulated quadrupole mass spectrometer system was constructed in order to study the thermochemical properties of cesium–oxygen systems. The mass spectrometer system was calibrated with pure cesium in the Knudsen cell. The cell was charged with cesium oxide which had been formed according to the stoichiometry of CsO. Rigorous definitions of electronegativity of atoms, neutral or ionized, are given. The emission characteristics of vapor-deposited tungsten emitter with a molybdenum collector were investigated in a variable-spacing converter. The microstructure of vapor-deposited tungsten and its response to heat treatment was examined by X-ray diffraction methods. A theoretical study of the plasma phenomena in a cesium thermionic converter, using a set of plasma equations and a computer program for numerical results, is presented. F.O.S.

N69-33528*# California Univ., Berkeley. Lawrence Radiation Lab.
ELECTRON SPIN RESONANCE STUDIES OF H SUB 2 O RADIOLYSIS AND LINEAR ACCELERATOR DEVELOPMENT DIRECTED TOWARD ESTABLISHMENT OF PULSE RADIOLYSIS FACILITIES
Thomas E. Gunter *In its* Joint NASA-AEC Program in space Radiation Biol. Sep. 1967 p 3–7 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 07E

The OH produced by radiolysis of H_2O was investigated by use of electron spin resonance in single crystals of ice, $CaSO_4 \cdot 2H_2O$, and $Li_2SO_4 \cdot H_2O$. These studies were carried out

at 77°K except for a few preliminary studies carried out at 4.2°K. The effective spin Hamiltonian was determined for OH trapped in each of the above-mentioned crystal lattices. For ice, the experimentally determined spectroscopic splitting tensor was shown to be in agreement with that predicted by an LCAO MO calculation. In the irradiated sulfates, magnetic resonance spectra of OH, H atoms, and some form of trapped electron were observed. K.R.G.

N69-33529*# California Univ., Berkeley. Lawrence Radiation Lab.
PRODUCTION OF FREE RADICALS AND RADIATION DAMAGE IN TRYPSIN BY IRRADIATION WITH ELECTRONS AT 4.2° K.
W. Barrie Jones *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 9-18 refs (See N69-33572 19-04)
Avail: CFSTI CSCL 07C

Dry powdered trypsin, twice crystallized, was irradiated with 6.5 MeV electrons to give doses of 1 to 20 Mrad at a dose rate of approximately 1 Mrad/min. It was found that trypsin displayed the same radiosensitivity at liquid helium temperatures as at liquid nitrogen temperatures. The ESR spectrum of trypsin irradiated at 4.2°K consists of an unresolved doublet with a linewidth (both lines) of 24.85 Oe, with spectroscopic g values g_D (both lines) = 2.0021 and $g_{laser\ line}$ = 2.0010. Although one of the simplest processes by which the normal chemical binding could be altered to produce a free radical would be the removal of a hydrogen atom, no hydrogen atoms were seen. K.R.G.

N69-33530*# California Univ., Berkeley. Lawrence Radiation Lab.
EXCITED ELECTRONIC STATES IN NUCLEIC ACID COMPONENTS AND THEIR RELATION TO RADIATION DAMAGE
Martin D. Shetlar *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 19-23 (See N69-33527 19-04)
Avail: CFSTI CSCL 07C

Preliminary triplet-triplet absorption studies were carried out on thymine and uracil and the results of the phosphorescence and fluorescence studies of previous workers were confirmed. Faint absorption regions in the near infrared region were observed, but the regions were not of sufficient intensity to allow definite conclusions to be made. Four reactions were studied using triplet quenching methods: (1) uracil in methanol; (2) n,n-dimethyluracil in methanol; (3) uridylic acid in methanol; and (4) uridine in ethanol. K.R.G.

N69-33551# Technische Hochschule Munchen (West Germany).
ELECTRON SPIN RESONANCE STUDIES OF RADIATION-INDUCED FREE RADICALS OF CHOLESTEROL [ELEKTRON-SPIN-RESONANZ-UNTERSUCHUNGEN STRAHLENINDUZIERTER FREIER RADIKALE DES CHOLESTERINS]
Otto Hellinger (Ph.D. Thesis) 1969 77 p refs In GERMAN
Avail: CFSTI

The X-ray irradiation and ESR-spectroscopy of pure cholesterol at −196° C established the existence of two radiation-induced free radicals produced through changes in the side chain of the molecule. At constantly increasing temperature, these free radicals change irreversibly into the cholesteryl 7 radical above room temperature, probably due to H abstraction of a cholesterol molecule on the carbon 7 atom. The production and kinetics of the radiation-induced peroxy radical of cholesterol were for the first time studied in the liquid phase by a photochemical initiation system. The formation reaction of this cholesteryl 7 peroxy radical at room temperature in a cyclohexane solution was found to be nearly completely diffusion controlled. The dissociation reaction kinetics and products were also analyzed. As a result of the study, it is possible to define the radiation-induced changes in the cholesterol radical in the solid as well as in the liquid phase. Transl. by K.W.

N69-33667# Avco-Everett Research Lab., Everett, Mass.
OSCILLATOR STRENGTHS OF TRANSITIONS BETWEEN RYDBERG STATES OF NITRIC OXIDE IN SHE NEAR IR
Kurt L. Wray Feb. 1969 38 p refs Submitted for publication
(Contract F04701-68-C-0036; ARPA Order 1062)
(AD-687598; SAMSO-TR-69-29; RR-300) Avail: CFSTI CSCL 7/4

In recent years several shock tube studies have been made of the radiation emanating from hot air and nitrogen in the near IR. These investigations showed about 10 times more radiation from air than could be accounted for on the basis of the N2(+1) band systems alone; however, there has been some controversy as to the source of this excess air radiation. The present experiments utilized a continuously running 1 atm constricted arc jet to prepare equilibrium air and nitrogen at temperatures between 3500 and 5800K. The excess air radiation was confirmed, and it was shown that it requires the presence of both N and O nuclei. High resolution spectra (13A) were obtained from .9 to 1.2 microns employing a scanning monochromator and photomultiplier. Most of the features of these air spectra could be correlated with transitions arising between Rydberg states of NO. Employing the available spectroscopic parameters, theoretical calculations of the wavelength dependence of the radiation were made. By comparing the calculated total synthetic spectra with the experimental spectra, f-numbers for nine NO Rydberg systems have been evaluated.
Author (TAB)

N69-33683# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
INVESTIGATIONS OF THE FLUORO GALLATES AND THE FLUORO INDATES [UNTERSUCHUNGEN DER FLUORO-GALLATE UND DER FLUORO-INDATE]
J. Siftar and P. Bukovec Mar. 1969 6 p refs In GERMAN
Presented at 2nd European Fluor-Symp., Goettingen, West Ger., 1968
(NIJS-R-556) Avail: CFSTI

Conditions for obtaining fluoro gallates and fluoro indates from alkali metals in watery solutions and from ammonium were studied. Several compounds were synthesized with hydrazine (+1 and +2) -ions. Reaction phases during thermal degradation of the alkali metal-fluoro-water-metallates and the hydrazine compounds were characterized by X-ray and ultra red spectrum analyses.
Transl. by G.G.

N69-33686# Technische Hochschule Munchen (West Germany).
FLASH-PHOTOMETRIC MEASUREMENTS IN THE NANOSECOND RANGE OF ORGANIC MOLECULES IN SOLUTION [BLITZPHOTOMETRISCHE MESSUNGEN IM NANOSEKUNDENBEREICH AN LOESUNGEN ORGANISCHER MOLEKUELE]
Helmut Kausen (Ph.D. Thesis) 1968 121 p refs In GERMAN
Avail: CFSTI

Room temperature high resolution flash photometric measurements on triplet lifetimes in benzophenone were reported for 1.45 ± 0.05 (μ sec). The directly measured lifetime velocity (down to 310 nsec) of the activated triplet-triplet energy transfer from benzophenone to acceptor solutions depended on the acceptor concentration and showed good agreement with the energy exchange theory for excited pairs. Flash studies on several solutions to determine the lifetime and spectral zone of the luminescence established the transfer mechanism as a dipole-dipole interaction, partly overlapping with components from dipole-quadrupole couplings. Transl. by G.G.

N69-33586# Technische Hochschule Munchen (West Germany).
THE AMINO ACID POOL OF BREWER'S YEAST AND ITS DEPENDENCE ON VARIOUS ENVIRONMENTAL FACTORS [DER AMINOSAEURENPOOL DE BIERHEFE IN SEINER ABHAENGIGKEIT VON VERSCHIEDENEN UMWELTFAKTOREN]
Peter Gramsamer (Ph.D. Thesis) 1969 89 p refs In GERMAN
Avail: CFSTI

Studied are the effects of oxygen composition, nitrogen source, temperature, and yeast type on its nitrogen and amino acid pool with emphasis on pool size differences for under-fermenting and over-fermenting beer yeasts. Zymological measurements show that the amino acid pool of over-fermenting yeasts reacts much more sensitive to oxygen than the under-fermenting yeast pool; anaerobic conditions promote the accumulation of free pipecoline acid and amino butyric acid. Caseinhydrolysate and peptone are the optimal nitrogen sources. The percentage of pool-nitrogen in the overall nitrogen content of the cell is highest at low culture breading temperatures. Increased subculture succession decreases the amount of free amino acids in the beer yeast cell.
Transl. by G.G.

N69-33587# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.
SPONTANEOUS ANALYSIS IN METALLURGY BY MAKING USE OF PROMPT [n, gamma] PROCESSES [SPONTANANALYSE IN DER METALLURGIE DURCH AUSNUTZUNG DER PROMPTEN [n, gamma] PROZESSE]
M. J. Higatsberger 1969 27 p refs In GERMAN
(SGAE-G-11/1969) Avail: CFSTI

Neutron activation methods are described for monitoring the automatic steel fabrication through constant determination of melt properties. Germanium lithium detectors are used to measure promptly photon-neutron energies developing from neutron bombarded melts. Results show that it is possible with this method to determine 1% manganese content in iron with an accuracy of 10%.
Transl. by G.G.

N69-33591# Eidgenossische Technische Hochschule, Zurich (Switzerland).
REACTION-KINETICS STUDIES OF THE HYDRATION OF ACETYLENE TO ACETALDEHYDE ON MODIFIED MOLECULAR SIEVES [REAKTIONSKINETISCHE UNTERSUCHUNGEN DER HYDRATISIERUNG VON ACETYLEN ZU ACETALDEHYD AN MODIFIZIERTEN MOLEKULARSIEBEN]
Klaus Aufdereggen (Ph.D. Thesis) 1968 124 p refs In GERMAN
Its Diss. No. 4053
Avail: CFSTI

Hydration in the liquid and gas phases was considered, with emphasis on criteria for the selection of suitable catalyst systems. Kinetics and activities of the ions of mercury (II), cadmium (II), zinc (II), copper (II), copper (I), and silver (I) were compared, and ion exchange was used to produce 13X molecular sieves from these metal ions. The macrokinetics of the catalytic gas phase hydration between 110° and 424° C were studied with these sieves in a differential reactor. Acetaldehyde and small amounts of crotonaldehyde were the main resulting products. Initial hydration rates, reaction constants, rates of poisoning, and changes in the catalytic activity were determined. The influence of the material transport outside of the grain and the pore diffusion were calculated for the zinc 13X molecular sieve, and type and composition of the poison were studied on zinc contacts. The regeneration of the catalysts was also considered.
Transl. by K.W.

N69-33598*# Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
THE INTERACTION OF OXYGEN ATOMS WITH SOLID SURFACES AT eV ENERGIES Annual Status Report, 1 Jun. 1968-31 May 1969
G. D. Magnuson, J. W. Boring, and R. R. Humphris Jun. 1969 17 p refs
(Grant NGR-47-005-077)
(NASA-CR-103829; AEEP-4011-104-69U; AR-2) Avail: CFSTI CSCL 07D

The distribution of masses that result when oxygen atoms strike a solid surface are investigated in the kinetic energy range of four to ten electron volts, corresponding to velocities in the satellite range. The possibility that the oxygen atoms spend a relatively long time on the surface and, as a consequence, the character of the particles leaving the surface does not depend on the energy of the incident atoms is considered. However, measurements indicate that the molecules leaving the surface have not accommodated to the surface temperature, and have probably had only a few collisions with surface atoms. It is concluded that the use of ion beams to measure recombination coefficients is more advantageous than using neutral beams.
F.O.S.

N69-33605# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE HEAT EXCHANGE DURING THE HETEROGENEOUS GAS CATALYSIS IN THE SOLID-BED REACTOR [UEBER DEN WAERMEAUSTAUSCH BEI DER HETEROGENEN GASKATALYSE IM FESTBETTREAKTOR]
Eduard Thelmann (Ph.D. Thesis) 1968 84 p refs In GERMAN
Its Diss. No. 3973
Avail: CFSTI

The heat transfer in a solid-bed tube reactor, steam-heated from the outside, with an air current passing through the tube was studied. Quartz particles of various diameters served as the filler material. The relationship between heat transport and gas velocity can be described by the general power law $Nu = a \cdot (Re_p)^b$. Temperature dependences of the thermodynamic equilibrium constants, the specific heat of the reactants, and the reaction enthalpy for toluol hydration were calculated. The kinetics of a catalytic toluol hydration were investigated on a nickel catalyst in a differential reactor. Concentration and mixing temperature length profiles were measured for constant and variable contact durations and toluol concentrations. Benzene was also hydrated. The material and energy balance was differentially formulated for calculating the concentration and mixing temperature length profiles. The kinetics obtained in the differential reactor were used to compute the profiles in an integral reactor. A comparison of computed with measured Nusselt numbers proved that the heat transfer was not affected by the chemical reaction process.
Transl. by K.W.

N69-33608*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
HYDRAZINE ELECTROLYSIS CELL SAFETY LIMITS TESTS
N. E. Morgan 3 Jun. 1969 47 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951720)
(NASA-CR-103889) Avail: CFSTI CSCL 07D

The work reported is a continuation of a previous program of testing an experimental hydrazine electrolysis cell. The purpose of this program was to investigate the performance of the electrolysis cell at extreme conditions of voltage, current, and temperature to determine if any controllability problems existed. Early in the planned test program a failure which destroyed the electrolysis cell was experienced. The subsequent failure investigation indicated that the probable cause was thermal decomposition due to local hot spot on the cathode screen.
Author

N69-33611# Eidgenossische Technische Hochschule, Zurich (Switzerland).
PART 1: METHOD FOR MEASURING THE DIELECTRIC CONSTANT BY MEANS OF A EPR SPECTROMETER. PART 2: EPR SPECTROSCOPY OF RADICALS AND TRIPLET CONDITIONS OF INDOLES [TEIL 1: METHODE ZUR MESSUNG DER DIELEKTRIZITAETSKONSTANTEN MITTELS EINES EPR-SPEKTROMETERS. TEIL 2: EPR-SPEKTROSKOPIE VON RADIKALEN UND TRIPLETTZUSTAENDEN VON IDOLEN]
Zeppos Haniotis (Ph.D. Thesis) 1968 90 p refs In GERMAN
Its Diss. No. 4052
Avail: CFSTI

Described is a method for measuring the dielectric constants and loss factors of isotropic substances at microwave frequencies. First order perturbation calculations are used to determine the correlation between the frequency and quality shifts in an electron paramagnetic resonance spectrometer cavity after sample introduction, as well as the real and projected electric susceptivity of the medium. Perturbation calculation results are then compared to exact solutions for the special case of the TE_{011}-cavity and thus the loss factor of binary mixtures of spectroscopic solutions is measured. Triplet states of naphthaline and indole are also studied and the electron paramagnetic spectrum of the indole and naphthaline triplet was reproduced. Transl. by G.G.

N69-33618# Technische Hochschule Munchen (West Germany).
ON THE DERIVATION AND REACTIVITY OF BIS-mu-ACYL DI-IRON HEXACARBONYL COMPLEXES, AND ON THE REGROUPING REACTIONS OF GROUP 6B METHYL METHOXYCARBENE COMPLEXES WITH SELENOPHENOL [UEBER DIE DARSTELLUNG UND REAKTIVITAET VON BIS-mu-ACYL-DIEISENHEXACARBONYL-KOMPLEXEN UND UEBER UMLAGERUNGSREAKTIONEN AN METHYL-METHOXYCARBEN-KOMPLEXEN DER 6. NEBENGRUPPE MIT SELENOPHENOL]
Volker Kiener (Ph.D. Thesis) 1969 72 p refs In GERMAN
Avail: CFSTI

Investigated was the behavior of iron pentacarbonye during reactions of hexa- and penta-coordinated carbonyl complexes with organic lithium compounds. The newly obtained derivation of acylcarbonylferrates with high affinities toward electron donor ligands was used to synthesize numerous acyl-bound carbonyl complexes and to obtain a regrouping for carbene complexes of the sixth para group with selenophenol. Transl. by G.G.

N69-33625# United Kingdom Atomic Energy Authority, Harwell (England).
RATE CONSTANTS FOR THE REACTIONS OF CERTAIN DYES WITH HO SUB 2 RADICALS AND HYDRATED ELECTRONS FORMED BY THE Co-60 GAMMA-RADIOLYSIS OF AQUEOUS SOLUTIONS
N. T. Rakintzis [1968] 6 p refs Transl. into ENGLISH from Z. Phys. Chem. (Frankfurt), no. 57, 1968 p 99–102
(NP-TR-1764) Avail: AEC Depository Libraries

Radiolysis of aqueous dye solutions was carried out to determine the effects of HO_2 radicals on the dye and the rates of the reactions. The rates were much slower than those for OH radicals. Calculated values for rates of reactions of hydrated electrons with dyes are presented. NSA

N69-33702# United Kingdom Atomic Energy Authority, Harwell (England).
EFFECT OF DOSE RATE ON THE KINETICS OF CYCLOHEXANE RADIOLYSIS. CYCLOHEXANE AS A CHEMICAL DOSIMETRY SYSTEM
V. I. Makarov and L. S. Polak [1968] 9 p refs Transl. into ENGLISH from Neftekhim. (Moscow), no. 7, 1967 p 219–223
(NP-tr-1761) Avail: CFSTI; HMSO

Kinetics of cyclohexane radiolysis product yields (hydrogen, bicyclohexyl, cyclohexene, and fragment products of C_1 to C_4) were studied at various doses from 1.4×10^{14} to 3.6×10^{16} eV/ml sec (in some cases up to 2.8×10^{17} eV/ml sec) and at γ- and electron-irradiation doses from 1×10^{19} to 15×10^{19} eV/ml. The basic radiochemical yields of cyclohexane products resulting from the broken C–H bonds did not prove to be a linear function of the dose. The rate of the yield of products was not affected by the radiation dose range examined. NSA

N69-33706# Mound Lab., Miamisburg, Ohio.
A SUMMARY OF THE PHASE DIAGRAMS AND COMPATIBILITY OF PLUTONIUM DIOXIDE WITH VARIOUS MATERIALS
J. E. Selle 21 Apr. 1969 38 p refs
(Contract AT(33-1)-GEN-33)
(MLM-1589) Avail: CFSTI

A compilation of the available information on the phase diagrams and compatibility of PuO_2 with various materials is presented. X-ray data are given when available, along with a complete list of references. Author (NSA)

N69-33711# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
CHEMISTRY DEPARTMENT Semiannual Report, Dec. 1966–May 1967 [RAPPORT SEMESTRIEL DU DEPARTMENT DE CHIMIE, DECEMBRE 1966–MAI 1967]
Dec. 1967 545 p refs In FRENCH
(CEA-N-856) Avail: CFSTI

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N69-33712# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
CHEMICAL ANALYSIS [ANALYSE CHIMIQUE]

In its Chem. Dept. Dec. 1967 p 3–56 refs (See N69-33711 19-06)
(ANL-Trans-610-Sect-1) Avail: CFSTI

The development of analyses connected with Pu are outlined. These include the determination of nitrogen in Pu, on-line analysis of nitrates in Pu solutions, separation of Pu for its determination in solutions from the dissolution of irradiated fuels, chromatography and electromigration of transuranium elements, mass spectrometry of fuel elements to determine the isotopic composition of Pu and of U, determination of carbon traces, and recovery of Pu in a small installation utilizing classical methods of treatment. The efficiency of coulometric determination of Pu in reconstituted fuels with Pu contents from 0.15 to 0.3% was studied. A maximum systematic deviation of 0.4% was obtained. A second α, β, γ installation for the analysis of irradiated fuel elements was constructed and its design is briefly outlined. Developments made in chemical and electrochemical analytical techniques are reported. NSA

N69-33713# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
TREATMENT OF MODERATELY AND WEAKLY ACTIVE EFFLUENTS [TRAITEMENT DES EFFLUENTS MOYENNEMENT ET FAIBLEMENT ACTIFS]
In its Chem. Dept. Dec. 1967 p 57–70 (See N69-33711 19-06)
Avail: CFSTI

The pilot plant at Saclay for ion-exchange decontamination of low-activity effluents (2 to 5×10^{-2} Ci.m^{-3}) is described. An example is given of the evolution of γ emitters during different phases of the treatment. The strontium carbonate process for treatment of effluents is schematized. This procedure was studied in order to eliminate the radioactive Sr. Preliminary results showed that in order to obtain good separation it is necessary to separate the effluents of chemical decladding that are rich in Mg. Use of cobalt ferrocyanide and manganese oxide hydrates for precipitation of radioelements present in evaporator concentrates was applied to Marcoule and to Fontenay-aux-Roses concentrates. A procedure was defined for biodegradation tests of detergents. The procedure is divided into the three steps: constitution of a bacterial bed, sensitization of the bed, and biodegradation. NSA

N69-33714# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
TREATMENT OF URANIUM [TRAITEMENT DE L'URANIUM]
In its Chem. Dept. Dec. 1967 p 71–77 (See N69-33711 19-06)
Avail: CFSTI

In the installation for processing of enriched uranium, the recovery of uranium with 30% enrichment in ^{235}U from Masurca wastes was improved by the homogenization of solutions before their reaction with nitric acid. The soda dissolver designed for the T mill for processing of enriched uranium can operate either continuously or in batch quantities, which will make it possible for the mill itself to be operated either in batch or continuous operation. The optimum conditions for production of frittable uranium dioxide beginning with uranium hexafluoride were determined for each of the three operational steps: precipitation of ammonium uranate, pyrohydrolysis of the diuranate, and reduction of the oxide triuranium octoxide. NSA

N69-33715# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ELECTROCHEMICAL STUDIES [ETUDES D'ELECTROCHIMIE]
In its Chem. Dept. Dec. 1967 p 78–86 (See N69-33711 19-06)
Avail: CFSTI

The first results obtained on the production of frittable UO_2 by igneous electrolysis showed that with the technique used the yield is 80 to 90% and the powder obtained is remarkably well crystallized. The corrosion of Ag in a fused chloride bath was studied and the results showed that a thermal gradient considerably increases the intragranular attack on Ag. In a study of the conductivity of fused salts and of the electrode-fused salt interface it was shown that deviations from the volumetric ideal of the mixtures are less than 1% whereas deviations from the conductimetric ideal are much larger. The conditions for electrocrystallization in fused salts in order to obtain compact deposits of W and Ni were investigated. Measurements were made of the adherence of cadmium deposits on steel, with and without preliminary charging with hydrogen. The results show that in the majority of cases the rupture takes place in the cadmium deposit and not at the cadmium–steel interface. NSA

N69-33716# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
CORROSION STUDIES [ETUDES DE CORROSION]
In its Chem. Dept. Dec. 1967 p 87–121 refs (See N69-33711 19-06)
(ANL-Trans-610-Sect-4) Avail: CFSTI

The behavior of Zr–Fe (2% Fe) and Zr–Fe–Cu (2% Fe and 2% Cu) in the cold-worked state or in the β-annealed-quenched state exposed to the effect of water vapor at 500°C for durations of 1 to 6 months was studied. The initial structure of the cold-worked alloy is characterized by numerous precipitates of warped form, but in the tempered state no trace of precipitation is detectable in the binary alloy. Studies on the effects of additions of Mo and of Mo + Si on the corrosion of Fe–Cr–Ni austenitic alloys showed that these additions have a beneficial effect. Steels with additions of Mo are less sensitive to stress corrosion than steels without the Mo additions. NSA

N69-33717# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
VARIOUS CHEMICAL STUDIES [ETUDES CHIMIQUE DIVERSES]
In its Chem. Dept. Dec. 1967 p 122–133 (See N69-33711 19-06)
Avail: CFSTI

A study of salt water softening is presented. The study concerns the exploration of a resin bed with mobile gravity. The resins are contained in two identical columns of 50 mm. These resins are partially evaporated in the lab. Tested also were small columns working in a fixed course influenced by the velocity and prelocation. Included is a study of rust resistant austenitic stainless steel. The tests were performed at high temperature, and were influenced by the cations present in the chlorine ions, oxygen present, and the addition of molybdenum to the steel. Results indicate these additions improve the crack reactions in the steel.
Transl. by E.H.W.

N69-33718# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF PROCESSES OF TREATMENT BY AQUEOUS METHOD: LABORATORY [ETUDE DES PROCEDES DE TRAITMENT PAR VOIE AQUEUSE: LABORATOIRE]
In its Chem. Dept. Dec. 1967 p 134–238 refs (See N69-33711 19-06)
(ANL-Trans-619-Sect-7) Avail: CFSTI

Topics covered include: influence of possible modifications n graphite–gas fuels on their chemical processing, oxidation and eduction of plutonium, boiling of aqueous solutions containing

tributyl phosphate, plutonium oxalate precipitation, plutonium recovery cycle, processing of highly irradiated enriched uranium oxides, extraction disturbance tests, the Rapsodie irradiated fuel reprocessing plant, and purification of plutonium by trilaurylamine extraction. NSA

N69-33719# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF PROCESSES OF TREATMENT BY AQUEOUS METHOD: PILOT PLANT [ETUDE DE PROCEDES DE TRAITMENT PAR VOIE AQUEUSE: ATELIER PILOTE]
In its Chem. Dept. Dec. 1967 p 237-272 ref (See N69-33711 19-06)
(ANL-Trans-626-Sect-8) Avail: CFSTI

Filtration and decontamination studies for processing a Mo-U alloy are described. Purification of plutonium by trilaurylamine extraction is considered. Studies were also made of the operation of pulsed columns and of the construction of a trilaurylamine regeneration unit. NSA

N69-33720# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF PROCESSES OF TREATMENT BY DRY METHOD [ETUDE DES PROCEDES DE TRAITMENT PAR VOIE SECHE]
In its Chem. Dept. Dec. 1967 p 273-297 refs (See N69-33711 19-06)
(ANL-Trans-626-Sect-9) Avail: CFSTI

Treatment of U-Zr and U-Al alloys by the fluoride volatility process is described. Separation of U and Pu from mixtures of their hexafluorides is discussed. Decladding of fuel elements by magnesium melting was studied. NSA

N69-33721# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
PREPARATION AND STUDY OF ACTINIDE ELEMENTS [PREPARATION ET ETUDE D'ELEMENTS ACTINIDES]
In its Chem. Dept. Dec. 1967 p 298-349 refs (See N69-33711 19-06)
(ANL-Trans-626-Sect-10) Avail: CFSTI

For analytical separation of Np from concentrated U solutions, inverse-phase chromatography with trilaurylamine (TLA) in reducing medium (Fe^{2+}, Pu^{3+}, Np^{4+}, U^{6+}) was investigated. The separation efficiency was determined on synthetic solutions and it was verified that the Np contained in a volume $V_F \leq 10$ ml of fixation solution is quantitatively extracted. The separation coefficients were determined for lanthanides and Am between the organic phase containing TLA and 40% HNO_3 in a mixture of 50% dodecane and 50% chlorobenzene and the aqueous phase with variable composition. The results show that it is possible to separate Am from the majority of lanthanides with high separation factors. The separation factors obtained for lanthanides and Am using tributyl phosphate, trioctylphosphine oxide, methyl dibutyl phosphonate, tributylphosphine, and diphosphonates were determined. The results are tabulated. NSA

N69-33722# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY ON THE VITRIFICATION OF SOLUTIONS OF FISSION PRODUCTS [ETUDE DE LA VITRIFICATION DES SOLUTIONS DE PRODUITS DE FISSION]
In its Chem. Dept. Dec. 1967 p 350-427 (See N69-33711 19-06)
(ANL-Trans-626-Sect-11) Avail: CFSTI

Studies on the vitrification of concentrated solutions of fission products were made on various types of solutions and on solid residues from dry processing methods. With respect to solutions from the processing of slightly alloyed U, the principal studies were on the perfecting of an induction furnace of the inactive model for the Marcoule pilot plant under construction and on the determination of the utilization program of this furnace. The first test series on the induction furnace are described in detail. With this series of tests the installation became operative. The preparation of active glass blocks is described. The thermal and electrostatic phenomena produced during storage of these blocks are examined. In a study of vitrification of solutions from the processing of U-Mo alloys, two techniques, pot vitrification and continuous calcination and vitrification, were investigated. NSA

N69-33723# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
FUNDAMENTAL STUDIES [ETUDES FONDAMENTALES]
In its Chem. Dept. Dec. 1967 p 428-433 refs (See N69-33711 19-06)
Avail: CFSTI

Acid constraints were studied in a solution of salt having the concentration .0001 C. The Robinson-Stokes theory on the coefficients of active ions is applied to the problem. Studied also is the normal deflecting couples of cerium III and IV. This test was performed in a solution of sulfuric acid. The results are presented on a graph. Transl. by E.H.W.

N69-33724# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDIES IN ACTIVE TECHNOLOGY [ETUDES DE TECHNOLOGIE ACTIVE]
In its Chem. Dept. Dec. 1967 p 434-444 (See N69-33711 19-06)
Avail: CFSTI

The installation for vitrification of fission products by the gel procedure in the Marcoule pilot plant for the processing of fuel elements has been in operation for three years. During this time repair of the components of the cell was made using remote-control devices. The repair techniques used, the transfer of tablets, and the processing of wastes, all by remote control, are described. The remote-control devices for repair and removal of large pieces of equipment are discussed. NSA

N69-33728# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
DESCRIPTION OF CARBON MONOXIDE FROM TUNGSTEN BY BOMBARDMENT WITH ELECTRONS
Robert Eugene Clausing (Ph.D. Thesis-Va. Univ.) Apr. 1969 139 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2307) Avail: CFSTI

A mass spectrometric technique to measure the quantity of neutral molecules released by electron impact from metallic surfaces covered with adsorbed gases was used to investigate the electron bombardment induced desorption of CO from W. It was possible to separate the effects of thermal desorption due to the very small amount of target heating that accompanied the electron bombardment from the effects of electron impact per se. The thermal effects were shown to be negligible for the conditions of this study. The desorption of neutral CO molecules from a W ribbon with predominantly [100] poles normal to the surface was measured for electron energies in the range from 30 to 8,000 electron volts. Between 3×10^{-6} and 6×10^{-5} molecules were desorbed per incident electron, depending upon the electron energy. Author (NSA)

N69-33788# McGill Univ., Montreal (Quebec). Dept. of Chemistry.
VISCOELASTICITY OF INORGANIC POLYMERS
Adi Eisenberg Feb. 1969 35 p refs
(Contract N00014-68-C-0237)
(AD-687449; TR-20) Avail: CFSTI CSCL 11/9

The viscoelastic properties of some inorganic polymers are reviewed. The materials are divided into two parts, i.e. those that exhibit bond interchange and those that do not. The materials which relax by simple diffusional motion are very similar in their properties to organic polymers. In those that exhibit bond interchange the time-temperature superposition principle is not operative, but creep compliances are additive so that in some cases it is possible to estimate the contribution of each of the mechanisms to the shear viscosity. Author (TAB)

N69-33812# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
RE-USE OF RADIOTHERMOLUMINESCENT LiF WITHOUT REGENERATION [REEMPLOI SANS REGENERATION DU LiF RADIOTHERMOLUMINESCENT]
Guy Portal, Henri Francois, and Philippe Blanchard Apr. 1969 16 p refs In FRENCH; ENGLISH summary
(CEA-R-3746) Avail: CFSTI

There is at the present time a rapid development of dosimetry techniques using thermoluminescence. Amongst the many substances actually in use, research laboratories generally employ lithium fluoride which is of particular interest for β radiation dosage and low-energy X and γ radiation. It might also be of use in radioprotection if its practical application were simpler. It has unstable traps situated just below the surface which adversely affect the measurements if the material is not regenerated before each operation and this process very much complicates radioprotection measurements. Lithium fluoride giving unstable peaks which are less pronounced than those of the commercially available product and which can therefore be used without regeneration have been prepared. In this report the thermoluminescence curves of these two products are compared. An analysis is given of the reasons for which this radiothermoluminescent product has a stable luminescence curve and can be used almost one hundred times without being regenerated. It is shown that this property can be retained when the LiF is used as a filler for teflon for applications in detectors. Author (ESRO)

N69-33826# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
APPLICATIONS OF ELECTRON PARAMAGNETIC RESONANCE TO SOME PROBLEMS OF RADIATION CHEMISTRY [APPLICATIONS DE LA RESONANCE PARAMAGNETIQUE ELECTRONIQUE A QUELQUES PROBLEMES DE CHIMIE SOUS RAYONNEMENT]
Claude Chachaty (Ph.D. Thesis--Paris Univ., 20 Jun. 1968) Mar. 1969 104 p refs In FRENCH; ENGLISH summary
(CEA-R-3537) Avail: CFSTI

The electron spin resonance (E.S.R.) spectra of irradiated polar organic glasses, at 77°K, shows a single line centered at g $\simeq$ 2, attributed to solvated electrons. The radicals produced on scavenging this species by electron acceptors, such as aromatic hydrocarbons, nitrocompounds and azines have been studied by E.S.R. In most cases, the radicals from these solutes, the spectra of which are observed after elimination by warming of the radicals from the matrices, are produced by protonation of the anions formed by scavenging of electrons at 77°K. Thus, in the case of glassy solutions of nitrocompounds, the radicals $R\,NO_2H$ are formed. They are characterized by a_N = 15 G (nitrobenzene) or a_N = 28 G (nitroalcane). These radicals are also generated by TV, photolysis at room temperature of solutions of nitrocompounds in alcohols and are shown to be the precursors of nitroxide radicals $R_2—N—O$ observed simultaneously. γ irradiation of solutions of pyridine and of the three diazines, in alcohol glasses at 77°K, produces the radical formed by hydrogen addition to these compounds. The value of the coupling constant of the additional proton (7–10 G) indicates that it is bound to a nitrogen in the sp^2 hybridation state. It can be shown, taking pyridine as an example, that the addition to a carbon gives a much greater value of the coupling constant, of the order of 50–60 G. Author (ESRO)

N69-33862# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
PROJECT SQUID Semiannual Progress Report, 1 Oct.–31 Mar. 1969
I. E Alber, J. B. Anderson, J. A. Fay, J. B. Fenn, A. Fontijn et al 1 Apr. 1969 65 p refs
(Contract N00014-67-A-0226-0005)
(AD-687431) Avail: CFSTI CSCL 21/5

The research programs covered in this report fall into the areas of fluid mechanics and MHD, atomic and molecular collisions, combustion and chemical rate processes, and chemi-ionization and ion-molecular reactions. Author (TAB)

N69-33870# Sunflower Army Ammunition Plant, Lawrence, Kans.
SOLVENTLESS (EXTRUDED) POWDER (N-5) GENERAL. COST IMPROVEMENT FOR INHIBITING PROCESS OF MARK 43 GRAIN. RECLAMATION OF RUN OFF ELBA SOLVENT BY DISTILLATION Final Report
Kiplin D. Cowan and J. A. Rasmussen Apr. 1969 37 p
(Contract DA-11-173-AMD-42(A))
(AD-687379; SUN-143-94) Avail: CFSTI CSCL 19/1

Used ELBA solvent (Ethyl Lactate/Butyl Acetate) contaminated with components of N-5 propellant and water, was reclaimed by vacuum and ambient pressure distillation. Nitroglycerin (NG), water, and butyl acetate contents of the distillates are reported. Water separation in the distillate is discussed. Nitroglycerin content and thermal stability of the residues are reported. Distillations were performed successfully. Ninety percent recovery was obtained. Stability studies showed that the contaminated solvent could be distilled safely. Author (TAB)

N69-33873# Massachusetts Univ., Amherst. Polymer Research Inst.
RHEO-OPTICS ON TWO CONTINENTS: AN EXAMPLE OF INTERNATIONAL COOPERATION IN SCIENCE
Richard S. Stein Apr. 1969 49 p refs
(Contract Nonr-3357(01))
(AD-687466; ONR-TR-114) Avail: CFSTI CSCL 7/4

Rheo-optical techniques for the study of crystalline polymers, developed primarily in the United States and Japan, include dynamic birefringence, x-ray diffraction, dichroism, light scattering and fluorescence. These permit the characterization of the rates of orientation of crystals, amorphous regions, and crystalline superstructures. The application of these methods has permitted the formulation of a model for the deformation of crystalline polymers. Author (TAB)

N69-33884# California Univ., Livermore. Lawrence Radiation Lab.
CHANGE IN THE COMPOSITION OF URANIUM OXIDE WHEN HEATED IN AIR
Kunihiro Goto [1968] 8 p refs Transl. into ENGLISH from Nippon Kagaku Zasshi (Tokyo), no. 89, 1968 p 927–929
(UCRL-Trans-10334) Avail: CFSTI

Uranium oxide powder was heated at various temperatures in air and the atomic ratio O/U in the equilibrium state was

determined. The compositions of U_3O_{8-z} in the air depends on the temperature and they are $UO_{2.650}$ at 650°C, $UO_{2.653}$ at 800°C, and $UO_{2.645}$ at 1000°C. When samples of uranium oxide are heated at 1000°C in the air, they suffer an irreversible loss in weight. The irreversible weight loss observed after heating for 100 hr is approximately 0.02% of the total weight. After being reduced in the hydrogen atmosphere, the equilibrium composition can be easily reached by heating in the air. NSA

N69-33897# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
HIGH TEMPERATURE ELASTIC CONSTANT MEASUREMENTS. APPLICATION TO PLUTONIUM [MESURE DES CONSTANTES ELASTIQUES A HAUTE TEMPERATURE. APPLICATION AU PLUTONIUM]
Jean-Marie Bouchet (Ph.D. Thesis–Paris Univ.) Mar. 1969 69 p refs In FRENCH; ENGLISH summary
(CEA-R-3771) Avail: CFSTI

An apparatus for the measurement of the Young's modulus and Poisson's ratio of several compounds using the resonance frequency of cylinders in the temperature range 0°C–700°C is described. Special attention was given to the elastic constants of plutonium and the first published data for the Young's modulus of Pu_δ and Pu_ϵ are E_δ 360°C = 1.6 10^{11} dy/cm^2, E_ϵ 490°C = 1.1 10^{11} dy/cm^2 (σ_ϵ = 0.25 ±0.03). Consequently, the compressibility, Debye temperature, Gruneisen constant and electronic specific heat of Pu_ϵ were calculated. Author (ESRO)

N69-33904# Technische Hogeschool, Eindhoven (Netherlands).
THERMOTRANSPORT OF OXYGEN AND NITROGEN IN BETA-ZIRCONIUM, BETA TITANIUM, NIOBIUM, AND TANTALUM
Daniel Lodewijk Vogel (Ph.D. Thesis) 24 Jun. 1969 170 p refs
Avail: CFSTI

The phenomenon of thermotransport in solid interstitial alloys is analyzed, and the equation for the flux of interstitial atoms in single phase binary alloys is derived. A computer program was written to solve the formula for the rate of thermotransport in a rectangular probe of constant thickness with a linear temperature gradient along its longitudinal axis. The apparatus and experimental procedures are described, and data are given on the properties of oxygen and nitrogen relative to zirconium, β-titanium, niobium, and tantalum. The results show the heat of transport of β-zirconium to be 21.3 kcal/mole with a standard deviation of 2.9 kcal/mole, and that of nitrogen 25.1 kcal/mole with a standard deviation of 2.5 kcal/mole. Oxygen and nitrogen in β-titanium were found to have positive heat of transport. There were strong indications that the heat of transport of oxygen in α-titanium is negative, while the heat of transport of oxygen and that of nitrogen is very slight in niobium. J.M.C.

N69-33939# Minnesota Univ., Minneapolis.
RESEARCH ON ION MOLECULE REACTIONS INVOLVING SPECIES IMPORTANT IN THE ATMOSPHERE. Final Report, 1 Oct. 1965–30 Jun. 1968
Clayton F. Giese Dec. 1968 9 p ref
(Contract AF 19(628)-5669)
(AD-687499) Avail: CFSTI CSCL 7/4

The report gives the status of three experiments: (1) Low energy ion reactions. In this experiment we measure angle and energy distributions of products from ion molecule reactions with mass spectrometer selected primary ion beams. A notable development is a particularly simple energy analyzer with high transmission and good resolution. (2) Low energy elastic scattering. This experiment is designed to operate below one eV energy and uses a unique system of masks with ring-shaped openings to define the scattering angle. (3) Penning effect. This experiment is intended to study the energy released as translational energy in Penning effect collisions, notably $He(^3) + O \cdot O(+) + He + e$. Author (TAB)

N69-33961# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ABSORPTION SPECTRUM OF STRONTIUM IODIDE IN THE REGION OF AUTOIONIZATION FROM 1646 TO 2028 ANGSTROM
Robert D. Hudson, Virginia L. Carter, and Paul A. Young (TRW Systems Group, Redondo Beach, Calif.) 14 Feb. 1969 26 p refs
(Contract F04701-68-C-0200)
(AD-688483; TR-0200(9280-01)-3; SAMSO-TR-69-131) Avail: CFSTI CSCL 7/4

The atomic absorption cross section of strontium has been measured at an instrumental bandwidth of 0.07 A in the autoionizing wavelength interval from 1646 to 2175 A. Corrections have been applied to eliminate the bandwidth dependence of the results. Figures summarizing the best estimate of cross section versus wavelength are presented. The observed structure is grouped into series, and the measured wavelengths and oscillator strengths for the members of each series are tabulated. Author (TAB)

N69-34021# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
COMPARATIVE STUDY OF THE IONIC EXCHANGE OF Ca^{++}, Sr^{++} AND Ba^{++} CATIONS ON RESINS AND INORGANIC EXCHANGERS [ETUDE COMPARATIVE DE L'ECHANGE IONIQUE DES CATIONS Ca^{++}, Sr^{++} et Ba^{++} SUR RESINE ET SUR ECHANGEURS MINERAUX]
Pedro Sanchez-Batanero (Ph.D. Thesis) Mar. 1968 136 p refs In FRENCH; ENGLISH summary
(CEA-R-3753) Avail: CFSTI

With a view to applying the results to certain problems related to chemical separations in activation analysis, a study has been made of the possibilities of separating the alkaline-earth elements Ca, Sr and Ba on organic resins and inorganic exchangers using the radioactive indicator method. The partition coefficients of the cations Ca^{2+}, Sr^{2+} and Ba^{2+} have been measured on Dowex 50 W $(NH_4^+)\times 8$ resin in the presence of EDTA - NTA - EGTA and DCTA as complexing agents, and on zirconium phosphate, tungstate and molybdate in the presence of HCl and NH_4Cl. Methods have been developed for separating mixtures of alkaline-earth elements using DCTA-NH_4^+ followed by elution on Dowex 50 W $(NH_4^+)\times 8$ resin columns and on zirconium phosphate. Amongst the complexing agents used on the ion-exchange resins the most promising appears to be DCTA which leads to partition coefficients Ca, Sr, and Ba which are very different. The results of measurements of partition coefficients on zirconium phosphate (NH_4^+ form) using DCTA-NH_4^+ show the interesting possibilities of separations on columns. The quantitative separation of the alkaline-earth elements is better with Dowex 50 resin than with zirconium phosphate; it is however much faster in the latter case and this can be useful for treating short half-life radioisotopes in activation analysis. Author (ESRO)

N69-34029# Army Foreign Science and Technology Center, Arlington, Va.
SOME ASPECTS OF KINETICS OF SOLID PHASE POLYMERIZATION
V. A. Kabanov et al Apr. 1969 17 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. (Moscow), v. 8, no. 9, 1966 p 1627–1634
(AD-687758; FSTC-HT-23-278-68) Avail: CFSTI CSCL 7/4

Solid phase polymerization is considered as a nonequilibrium phase transformation: Crystalline monomer - polymer. An expression is obtained for the dimension of the crystalline seed of the polymer phase with the assumption that it represents macromolecules which are packed in parallel. The notion was put forth that the S-shaped form of the kinetic curves of solid phase polymerization is connected with the slow generation and following rapid development of the polymer phase. The hypothesis was put forth that under the influence of radiations of high energy on the crystallaine monomer, hot areas are created in the crystalline monomer in which polymer chains may continue to grow and and which will turn out to be thermodynamically unstable when these hot areas are cooled; a further effect of radiation may be caused by the chain decay of these unstable molecules to the monomer state. It was shown that the formation of thermodynamically unstable chains in the crystal of the monomer, accompanying their formation by annealing and then by usual polymerization, may be in a number of cases the reason for the complicated character of the kinetics of solid phase polymerization under the effect of radiation. Author (TAB)

N69-34031# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A SEARCH FOR CARBON ATOMS Technical Report, Sep. 1967–Sep. 1968
A. Greenville Whittaker and Paul L. Kintner Oct. 1968 16 p refs
(Contract F04701-68-C-0200)
(AD-687872; TR-0200(4250-40)-1; SAMSO-TR-69-123) Avail: CFSTI CSCL 7/4

Attempts were made to measure carbon atom concentration in graphite vapor by using optical absorption of the carbon resonance multiplet at 1657A. No carbon atoms could be detected in a variety of flow experiments. It was shown that this result was due to very rapid reactions of carbon atoms with other carbon species. Carbon atoms were detected in a static system when sublimation from the alpha direction of pyrolytic graphite was used. Under corresponding conditions, no carbon atoms could be detected if spectrographic grade of graphite was used as a vapor source. Emission of colloidal particles was observed during the sublimation of a variety of graphites. The particles were captured and characterized by use of the electron microscope. This study indicated that all the particles came directly from the subliming sample. There was no evidence that particles were formed by condensation of carbon from the vapor phase. Author (TAB)

N69-34032# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Metallurgy and Ceramics Research Lab.
DISSOLUTION BEHAVIOR OF Fe AND Ni IN THE ACTIVE REGION OF DISSOLUTION IN SULFURIC ACID Final Report
Dale O. Condit Jan. 1969 33 p refs
(AD-687866; ARL-69-0018) Avail: CFSTI CSCL 7/4

The dissolution characteristics of high purity Fe and high purity Ni in H2SO4 at 25C were investigated using atomic absorption analysis. The specimens were dissolved potentiostatically and samples of solution were analyzed for Fe and Ni ions. The analyses showed that the dissolution was a logarithmic function of time, the exponent of time being about 1.0 for Fe and 0.7 for Ni. Anodic polarization curves indicated that dissolution of Fe was larger than for Ni. The mechanism for Fe involved two electrons; whereas, for Ni it involved three electrons. Determination of zero-order rate constants indicated that the constants for both Fe and Ni increase with potential, the constant for Fe at a given potential always being much larger than the constant for Ni. Author (TAB)

N69-34045# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
BALANCE BETWEEN METALLIC PLUTONIUM AND ITS IONS. STUDY OF THE BALANCE BETWEEN METALLIC PLUTONIUM AND ITS IONS IN CHLORIDE EXTRACTS
V. I. Silin et al [1968] 10 p refs Transl into ENGLISH from Atomnaya Energ. (Moscow), no. 25, Jul. 1968 p 26–29
(REP-Trans-54) Avail: CFSTI

A dependence of equilibrium plutonium potentials in molten salts, $PuCl_3$–NaCl and $PuCl_3$–NaCl –KCl over the temperature range 710 to 870°C and a concentration of plutonium of 0.6 to 11.9 wt% was investigated. The following equations of temperature and concentration dependence of plutonium potential according to the Cl_2 reference electrode were obtained: for NaCl–$PuCl_3$, $E_1 = -3.605 + 9.83 \times 10^{-4}T + 0.661 \times 10^{-4}T \lg[Pu^{3+}]V$ and for NaCl–KCl–PuCl3, E2 = –3.577 + 9.25 × 10-4T + 0..661 × 10-4T lg [Pu3 +]v. The thermodynamic values of PuCl3 formation and its interaction with salt-solvent are determined. Author (NSA)

N69-34065# Gulf General Atomic, San Diego, Calif.
CHEMICAL REACTIONS USING MODULATED ATOMIC BEAM TECHNIQUES Final Scientific Report, 1 Apr. 1968–31 Mar. 1969
J. N. Smith, Jr. 14 Apr. 1969 81 p refs
(Contract F44620-68-C-0067)
(AD-688617; GA-9332; AFOSR-69-1066TR) Avail: CFSTI CSCL 7/4

The hydrogen-deuterium exchange reaction on nickel was studied using modulated molecular beam techniques. When coupled with a surface preparation technique that allows one to grow clean single crystals in situ during the experiment, it is shown that the scattering of H2, D2, and HD is specularly directed while the product of the H2/D2 exchange is scattered. The reaction probability implies the importance of the normal component of momentum in controlling the reaction rate. From these data and from earlier studies of the pressure dependence of the reaction the Langmuir type of mechanism is favored over a direct collisional (Rideal) type of mechanism in the exchange reaction H2 + D2 yielding 2HD. Further, it is apparent from the data that the role played by sorbed H2 is important in such reactions on Ni surfaces. Author (TAB)

N69-34089# California Univ., Livermore. Lawrence Radiation Lab.
NUMERICAL EQUATION OF STATE FOR ARGON
Keith W. Johnson 4 Mar. 1969 15 p refs
(UCRL-50579) Avail: CFSTI

A numerical equation of state for argon is developed by fitting shock-wave data and low-pressure isothermal data to the form P(isothermal data to the form $P(\mu,E) = A_1(\mu + 1)E$ Q $A_2\mu^2 + A_3\mu^3 + A_4$ Q $A_4\mu^4$ Q $A_5{}^2$ Q $A_6E\mu^3$, where P is the pressure, μ is the relative compression, E is the internal energy, and A_i is a coefficient. Release isentropes and rarefaction velocities are calculated from this equation. An example with one isentrope demonstrates that a series of shocks from liquid argon can drive a thin copper plate to a mass velocity that is 75 percent greater than that obtainable with a single shock having the same initial strength. Author (NSA)

N69-34115# Toronto Univ. (Ontario). Inst. for Aerospace Studis.
THEORY OF AUGER EJECTION OF ELECTRONS FROM METALS BY IONS Interim Report
Eric P. Wenaas and A. J. Howsmon Mar. 1969 92 p refs
(Grants AF-AFOSR-1481-68; NRCA5555)
(AD-687896; UTIAS-137; AFOSR-69-0998TR) CSCL 7/4

A theory of the ejection of electrons from atomically clean metals by slow ions of the noble gases arising from Auger transitions is presented. Scattering matrix elements are evaluated

from first principles and the secondary ejected electron energy distribution and total yield are found. The approach used in the solution of this problem is that of the quantum theory of scattering. This approach eliminates determining transition matrix elements per unit time as a function of the distance of the ion from the metal surface, and will allow the direct calculation of the secondary electron energy distribution, total yield, spatial distribution, position of most probable neutralization, and depth of origination of Auger electrons. The formal solution is applied to the situation of He(+) ions of low energy incident on atomically clean tungsten. Normal incidence is treated although the theory is not restricted to this case. Typical theoretical curves are presented and compared with the experimental results of others. A discussion of such effects as energy broadening, effective ionization energy, uncertainty principle effects, inelastic electron scattering, and density of electron states in metals is included. Author (TAB)

N69-34121# Harry Diamond Labs., Washington, D.C.
THE SURFACE TENSION AND DENSITY PROFILE IN THE VAN KAMPEN MODEL OF A VAN de WAALS FLUID IN A TWO-PHASE STATE
Dennis William McGuire Jan. 1969 24 p
(AD-687284; TR-1425) Avail: CFSTI CSCL 7/4

For the van Kampen model of a van der Waals fluid in a two-phase state, where the attractive part of the intermolecular potential is assumed to be of the Yukawa type, formulas for the surface tension and density profile are derived assuming the interface between the two phases is planar. These formulas give the surface tension gamma and the inverse of the density profile 1/n as definite integrals of explicitly known integrands and thus provide a means for calculating, by straight-forward numerical methods, the surface tension and density profile at any temperature. These integrals are evaluated analytically in the vicinity of the critical point and the results are found to be in agreement with the van der Waals-Cahn-Hilliard theory of surface tension in a van der Waals fluid near the critical point. This theory, found in the recent work of Cahn and Hilliard, is compared in detail with our critical point calculation and their equivalence is demonstrated. Author (TAB)

N69-34128# Los Alamos Scientific Lab., N.Mex.
ANALYTICAL METHOD FOR UNFOLDING GAMMA-RAY SPECTRA
W. M. Sanders and D. M. Holm 19 Mar. 1969 110 p
(Contract W-7405-ENG-36)
(LA-4030) Avail: CFSTI

An analytical method and a computer code are described for unfolding complex gamma-ray spectra obtained with Ge(Li) detectors. The computer code will analyze 20 independent regions in a spectrum, with up to 350 data points and 11 full-energy lines in each region. Gaussian and exponential functions represent the data analytically. The best least-squares values of the energy, area, and width can be obtained for each full-energy peak. This report discusses the analytical techniques used and outlines the use of the code. Author (NSA)

N69-34140# Commissariat à l'Energie Atomique, Pierrelatte (France).
MOLYBDENUM AND TUNGSTEN OXYTETRAFLUORIDES [LES OXYTETRAFLUORURES DE MOLYBDENE ET DE TUNGSTENE]
Jean Reynes Apr. 1969 13 p refs In FRENCH; ENGLISH summary
(CEA-BIB-143) Avail: CFSTI

This bibliography includes the description of the preparation methods and specific properties of molybdenum and tungsten oxytetrafluorides. These two compounds were discovered in 1905–1907 but, except for their physical properties, their chemical properties are still little known today. The bibliography was completed in January 1968 and contains 20 references. Author (ESRO)

N69-34141# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
CHEMILUMINESCENCE AND CHEMI-IONIZATION IN NITROGEN ATOM/OXYGEN ATOM/CARBON COMPOUND REACTIONS
Arthur Fontijn (AeroChem Res. Labs.) Apr. 1969 29 p refs Presented at the Intern. Chemiluminescence Conf., Desert Hot Springs, Calif., 17–19 Mar. 1969
(Contract N00014-67-A-0226-0005; Proj. Squid)
(AD-687432; SQUID-TR-AC-8-PU) Avail: CFSTI CSCL 7/4

The addition of certain carbon compounds (e.g., C2F4, C2H4 and C2H2) to atomic N/O mixtures results in emission of the CO Fourth Positive Bands (A singlet Pi - X singlet Sigma), and in large increases in the NO(+) chemi-ion formation rate. Addition of C2F4 also produces increases of the intensity of the NO gamma bands (A doublet Sigma - X doublet Pi), NO beta bands (B doublet Pi - X doublet Pi) and O(singlet S - singlet D) emission. The processes discussed should be distinguished from the formation of CHO(+) chemi-ions and CO(A singlet Pi) in the reactions of oxygen atoms with hydrocarbons such as C2H2. Author (TAB)

N69-34149# Oak Ridge National Lab., Tenn.
PARAMETERS FOR THE CALCULATION OF OSMOTIC AND ACTIVITY COEFFICIENTS AND TABLES OF THESE COEFFICIENTS FOR TWENTY-TWO AQUEOUS MIXTURES OF TWO ELECTROLYTES AT 25°C
R. M. Rush Apr. 1969 71 p
(Contract W-7405-eng-26)
(ORNL-4402) Avail: CFSTI

Parameters are given for the calculation of osmotic and activity coefficients for 31 aqueous mixtures of two electrolytes at 25°C. In addition, tables of osmotic and activity coefficients are given for 22 of these mixtures. Author (NSA)

N69-34156# United Kingdom Atomic Energy Authority, Harwell (England).
GRAVIMETRIC PROCEDURE FOR THE QUANTITATIVE DETERMINATION OF ZIRCONIUM AND NIOBIUM AS PHOSPHATE
C. G. Wallace Mar. 1969 15 p refs
(AERE-R-5999) Avail: CFSTI; HMSO 2s 6d

The recommended procedure involves evaporation of fluoride solutions of niobium or zirconium with nitric acid and a controlled excess of phosphoric acid. The phosphate precipitates produced after dilution are not hydrolyzed in aqueous ammonium nitrate or in dilute nitric acid solution. After ignition at 1100°C zirconium is quantitatively determined as the pyrophosphate, ZrP_2O_7, and niobium as the niobyl phosphate, $NbOPO_4$. Application to the analysis of zirconium–uranium mixtures showed that the separation of zirconium, from as much as ten times its weight of uranium, is quantitative in a single precipitation. The determination of niobium in the presence of uranium has a positive bias of approximately 2% after a single precipitation and slightly less than 1% after a double precipitation. Author (NSA)

N69-34168# Mound Lab., Miamisburg, Ohio.
RAPID ESTIMATION OF THE EQUILIBRIUM CONCENTRATION OF PU(V) IN DISPROPORTIONATED SOLUTIONS OF PU(IV)

G. L. Silver 1 May 1969 5 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1588) Avail: CFSTI

A method of rapidly estimating the equilibrium concentration of Pu(V) in solutions of disproportionated Pu(IV) is presented, and the estimated concentration of Pu(V) in solutions of HCl is compared to observed values. Author (NSA)

N69-34171# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THERMAL CONDUCTIVITY AND ELECTRICAL RESISTIVITY OF URANIUM OXYCARBIDE
J. Lambert Bates Mar. 1969 45 p refs
(Contract AT(45-1)-1830)
(BNWL-989) Avail: CFSTI

Thermal diffusivity decreased as oxygen content increased. Oxycarbides with the lowest oxygen content showed a decrease in α as temperature increased, whereas oxycarbides with the highest oxygen contents exhibited an increase in α as temperature increased. Thermal diffusivities of all specimens approach a common value of 0.05 cm^2/sec at the high temperatures. Calculated thermal conductivities near 1500°C are about 0.18 W/cm – °C, very near the reported values for nearly stoichiometric and slightly hypostoichiometric UC. Electric resistivity of uranium oxycarbides between room temperature and 1775°K increased as oxygen concentration increased from 2 to 16 at.%. Electronic thermal conductivity is predominant above about 1200°C; phonon conductivity is predominant at lower temperatures and decreases with increasing oxygen content. Author (NSA)

N69-34178# Atomic Weapons Research Establishment, Aldermaston (England).
ELECTRICAL BREAKDOWN BETWEEN ERBIUM OXIDE, ERBIUM DEUTERIDE, AND MOLYBDENUM ELECTRODES IN A VACUUM
W. D. Owen, M. H. Davies, and W. D. Powell Feb. 1969 32 p refs
(AWRE-O-1/69) Avail: CFSTI

The results are given of investigations of spark breakdown conditioning, gap dependence of pre-breakdown and breakdown parameters, and reverse polarity sparking carried out using erbium oxide and erbium deuteride cathodes with molybdenum anodes at residual pressures of $<10^{-9}$ torr. NSA

N69-34191# Globe-Union, Inc., Milwaukee, Wis.
ORGANIC ELECTROLYTE BATTERY Final Report
Guy D. McDonald Apr. 1969 62 p refs Prepared for Sandia Labs.
(SC-CR-69-3084) Avail: CFSTI

A technique was developed to rapidly screen potential cathode materials for a wide temperature range, −54 to +121°C, nonaqueous electrolyte battery. This screening technique, involving the testing of thin anodic films of materials, was applied to the chlorides, oxides, and fluorides of silver, copper, nickel, cobalt, iron, manganese, and chromium. The requirement that an anodic film of the material could be formed, which was stable in at least one of the five organic test solvents, limited the applicability of the screening technique. Of the materials to which this technique could be applied, cobalt oxide, iron oxide, and copper oxide failed too establish a reproducible open circuit potential in nonaqueous solvents. Silver chloride, silver oxide, and cupric fluoride, gave potentials in a nonaqueous medium that were reproducible to within one millivolt and behaved reversibly to the application of anodic and cathodic potential. Author (NSA)

N69-34214# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
THERMODYNAMIC CHARACTERISTICS OF HELIUM: FORMULAE AND TABLES [THERMODYNAMIQUES DE L'HELIUM: FORMULES ET TABLES]
Raymond Drut May 1969 62 p refs In FRENCH; ENGLISH summary
(CEA-R-3791) Avail: CFSTI

This report gathers together the thermodynamic characteristics of helium, He^4, for temperatures of between 20 and 1020°C and for pressures varying from 1 to 200 bars. The first part gives details about the methods used for drawing up the tables, the formulae used and the accuracy obtained. The second part gives values for the specific mass, compressibility coefficient, the enthalpy, the entropy, the specific heats, the dynamic viscosity and the thermal conductivity. Author (ESRO)

N69-34230# United Kingdom Atomic Energy Authority, Risley (England). The Reactor Group.
AN ELECTRON MICROSCOPE EXAMINATION OF THE ALPHA MANGANESE PRECIPITATE IN Mg-Mn CREEP SPECIMENS
D. J. Marsh 14 Aug. 1968 15 p refs
(TRG-1743(S)) Avail: CFSTI; UK 4s 0d

Electron microprobe and electron microscope examinations of the alpha manganese precipitate in a series of creep specimens, and thermally aged samples of Mg 0.7 to 1.5 wt% Mn alloys, are described. The precipitate forms in long thin laths and also as thick polygons. The lath form is favored at low temperatures, but both morphologies persist throughout the temperature range examined (350 to 560°C). Oriented zones denuded of precipitate during creep were also studied; no trace of precipitate was found up to the highest magnifications (× 100,000). No clear indications were found of the mechanism of origin of the denuded zones. Author (NSA)

N69-34268# Massachusetts Univ., Amherst. Dept. of Chemistry.
THE EFFECT OF MORPHOLOGY ON THE MECHANICAL AND RHEO-OPTICAL PROPERTIES OF A STYRENE-BUTADIENE-STYRENE BLOCK COPOLYMER
Garth L. Wilkes Apr. 1969 28 p refs
(Contract Nonr-3357(01))
(AD-687467; ONR-TR-115) Avail: CFSTI CSCL 11/9

The mechanical and rheo-optical properties of a styrene-butadiene-styrene block copolymer of a given chemical composition are dependent upon the morphology of the polymer as affected by the solvent system from which a polymer film is cast. Films cast from methyl ethyl ketone and from toluene are compared. Properties found to differ are the stress-strain curve, the birefringence-strain curve, stress relaxation, birefringence relaxation and the dynamic mechanical spectra. Author (TAB)

N69-34277# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Chemical Physics.
RESONANT AND NEAR RESONANT DIPOLE-DIPOLE INTERACTIONS WITH APPLICATION TO PRESSURE INDUCED SHIFTS OF INFRARED SPECTRAL LINES
Arieh Rosenberg and Harry Friedmann Nov. 1968 65 p refs
(Contract AF 61(052)-838)
(AD-687748; AFCRL-69-0118; SR-13) Avail: CFSTI CSCL 7/4

The secular equation for a pair of polar molecules undergoing dipole-dipole interaction is studied in detail. Particular attention is paid to accidental near-resonance between non-similar molecules. The secular equation is divided into a part including the near-resonant levels and a part including all other levels; the near-resonant part is diagonalized first, and the coupling to the other part is then

treated by second-order perturbation theory. The functional dependence of the perturbed energy levels and wave functions upon the intermolecular distance R and the measure of off-resonance between the near-resonant levels is given explicitly. This analysis is examplified by the interaction between HCl and DCl molecules, where near resonance occurs since the ratio between the rotational constants is approximately 2. The calculation is applied to the shift of the HCl vibration-rotation lines due to DCl pressure, and the oscillation with J of the DCl shifts due to HCl, using a static line-shape theory. Author (TAB)

N69-34306# Argonne National Lab., Ill. Chemistry Div.
SEPARATION OF MICROGRAM QUANTITIES OF Cf 252 AND Cm 248 BY EXTRACTION CHROMATOGRAPHY IN A HIGH-LEVEL CAVE
E. P. Horwitz, C. A. A. Bloomquist, J. A. Buzzell, and H. W. Harvey Feb. 1969 16 p refs
(Contract W-31-109-ENG-38)
(ANL-7546) Avail: CFSTI

The extraction chromatography technique was applied to the separation of microgram quantities of ^{248}Cm from hundred-microgram quantities of ^{252}Cf. The bis(2-ethylhexyl) ester of orthophosphoric acid adsorbed on hydrophobic Celite was used as the column material. Dilute nitric and hydrochloric acids were used as the elutriants. Column runs were performed in a high-level cave with 48-in. concrete shielding. Decontamination factors of ^{252}Cf from the ^{248}Cm of 10^8–10^9 were obtained in a single-column run. Author (NSA)

N69-34308*# Applied Electrochemistry, Inc., Mountain View, Calif.
DEVELOPMENT OF A CARBON DIOXIDE-WATER SOLID ELECTROLYTE ELECTROLYSIS SYSTEM Annual Report, 29 Mar. 1968 –28 May 1969
J. Weissbart, W. H. Smart, S. H. Inami, C. M. Mc Cullough, and S. A. Ring May 1969 8 p refs
(Contract NAS2-4843)
(NASA-CR-73358; AR-1) Avail: CFSTI CSCL 07D

A twelve-ampere multicell CO_2-H_2O electrolyzer employing stabilized zirconia electrolyte disks was designed, fabricated, tested and and operated to produce O_2 and carbon from CO_2 in conjunction with a catalytic CO disproportionator. Design principles applicable to solid oxide electrolyte devices of this type are presented. These principles include ceramic electrolyte in the form of plates, series electrical connection of cells, parallel gas flows, and gas-tight high-temperature seals. The twelve-ampere prototype used hot-pressed zirconia disks 6.35 cm in diameter and .109 cm thick, platinum electrodes, zirconia cell bodies and gas manifolds, and precious metal brazed seals. The size of each cell, 20 cm^2 of active area, is believed adequate for incorporation into a 127-ampere unit sufficient to supply O_2 for one man (two pounds per day). These cells electrolyzed CO_2 at 825 °C without significant electrode polarization in both single cell tests and connected together in the multi-cell unit. Application of data resulting from the fabrication and testing phases of this program to the development of larger units for O_2 recovery from CO_2 for use in aerospace life support systems is discussed. Author

N69-34337# Atlantic Richfield Hanford Co., Richland, Wash.
THE USE OF AgCl-LiF AS A CARRIER IN THE SPECTROGRAPHIC ANALYSIS OF PLUTONIUM FOR COBALT
W. L. Akers Mar. 1969 7 p refs
(ARH-1079) Avail: CFSTI

Studies were made using various materials to determine their usefulness as spectrographic carriers or carrier-buffers in the determination of cobalt in plutonium dioxide prepared from plutonium metal. Silver chloride-lithium fluoride proved superior to gallium oxide and sodium fluoride for this purpose. Author (NSA)

N69-34338# California Univ., Livermore. Lawrence Radiation Lab.
AUTOMATED PROCEDURE FOR COLORIMETRICALLY DETERMINING Au(III) IN SOLUTION
Lester P. Rigdon 26 Mar. 1968 9 p refs
(UCRL-50590) Avail: CFSTI

An automated method for extracting and spectrophotometrically determining Au(III) in solution was developed. The method is based on forming an $AuBr_4^-$/trioctylphosphine oxide complex,extracting the complex into chloroform, and measuring its absorption at 395 mμ in a dynamic system. Solutions containing 5 to 50 μg of Au(III) per milliliter can be analyzed with an accuracy of 5% or better. The method is applicable to mineralogical leaching solutions containing strong oxidants, Fe(III), and appreciable quantities of diverse anions and cations. Ethanolamine and possibly other amines seriously interfere by complexing Au(III) at a pH of 2 or more. Coulometric and spectral studies indicate a strong complex between Au(III) and ethanolamine. Author (NSA)

N69-34339# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
ISOTOPIC ANALYSIS BY OPTICAL SPECTROSCOPY
C. Ungureanu and I. Siara 1969 15 p refs
(IFA-IS-55) Avail: AEC Depository Libraries

Spectroscopic methods are being developed for quantitative analysis of the isotopic composition of hydrogen and oxygen. Equipment with high-frequency excitation (150 MHz-500W) on a Fabry-Perot spectrometer with photoelectric recording were employed. The isotopic structure was resolved by a Fabry–Perot interferometer scanned by magnetorestriction. NSA

N69-34361# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.
PLUTONIUM-URANIUM-CARBON SYSTEM
P. E. Potter Oct. 1968 40 p refs Presented at the IAEA Panel on Thermodyn. of Uranium and Plutonium Carbides, Vienna, Sep. 1968
(AERE-R-5922; CONF-680924-3) Avail: CFSTI; UK 5s 6d

Studies on the phase relationships and thermodynamic properties of the plutonium-uranium-carbon ternary system are reviewed and areas for future work defined. The main features of the system are that there are no ternary compounds and that there are regions of complete miscibility between uranium and plutonium monocarbides and also between the sesquicarbides. Author (NSA)

N69-34356# Argonne National Lab., Ill.
MASS-SPECTROMETRIC EFFUSION STUDY OF URANIUM MONOPHOSPHIDE
J. W. Reishus, G. E. Gunderson, P. M. Danielson, and R. K. Edwards Nov. 1968 18 p refs
(Contract W-31-109-eng-38)
(ANL-7514) Avail: CFSTI

A mass-spectrometric effusion study of the vaporization of uranium monophosphide was completed. Between 2073 and 2423 °K, the monophosphide does not vaporize congruently, but instead loses phosphorus preferentially, forming the two-phase

system, U(l) – UP_{1-x}(s). The vapor species observed were U(g), P(g), and P_2(g). A value for the enthalpy of sublimation of uranium at 298°K was found to be 129.0 ± 3.7 kcal/mole from averaging our second- and third-law values, which were in good agreement with each other. Author (NSA)

N69-34388# Kiev Univ. (USSR). Inst. fuer Angewandte Physik.
RADIATION INDUCED CONDUCTIVITY EFFECTS IN ORGANIC HALOGEN COMPOUNDS [DER STRAHLENINDUZIERTE LEITFAHIGKEITSEFFEKT IN WABRIGEN LOSUNGEN ORGANISCHER SUBSTANZEN]
K. Wolschendorf Bad Godesberg, W.Germany Bundesministerium fuer Wissenschaftliche Forschung Dec. 1968 23 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-68-52) Avail: AEC Depository Libraries

Radioinduced effects on conductivity in aqueous solutions of organic compounds were studied. The dependence of the conductivity on the applied dose was derived by means of simple reaction kinetics. Radiation effects on the solutions were determined and compared with that of the chloral hydrate system. The availability of the systems investigated for conductimetric dosimetry is discussed. Author (NSA)

N69-34386# Oak Ridge Natl. Lab., Tenn.
HIGH VACUUM PURIFICATION OF NIOBIUM AND TANTALUM AND ITS EFFECT ON THE ELECTRICAL RESISTANCE
Reiner-Joachim Dinter [1968] 19 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), no. 58, 1967 p 70–75 Sponsored by AEC
(ORNL-tr-2039) Avail: CFSTI

Experiments are described for freeing niobium and tantalum from interstitial impurities. By annealing in high vacuum, the content of interstitially dissolved foreign atoms was reduced to about 10 at.-ppM from an initial value of 3800 or 300 at.-ppM. Niobium specimens pretreated in this way did not show an electric conductivity recovery stage after plastic deformation and subsequent tempering at room temperature to 360°C, but instead a small continuous decrease in resistance was observed. The recovery of resistance of a purified specimen which has not been charged with gas is greater than the additional resistance caused by residual impurities, the latter resistance anneals out. The observed recovery may be due to annealing of structural point defects which have been produced during deformation. Author (NSA)

N69-34381# Argonne National Lab., Ill.
A HIGH-TEMPERATURE, FLUIDIZED-BED PROCESS FOR CONVERTING URANIUM DIOXIDE TO URANIUM MONOCARBIDE
John T. Holmes, John R. Pavlik, Paul A. Nelson, and Johan E. A. Graae Nov. 1968 16 p refs
(Contract W-31-109-eng-38)
(ANL-7482) Avail: CFSTI

A fluidized-bed process was studied for the conversion of UO_2 to UC. The process involves making composite particles of UO_2 and graphite and reacting them at 1450 to 1800°C in a fluidized-bed reactor using an inert gas (helium or argon) for fluidization. High reaction rates can be achieved over a wide range of process conditions. Product purity compares with that obtained in other carbothermic reaction processes. At the present state of development, bed sintering has not been completely eliminated and thus may prevent rapid removal of all of the reaction product from the fluidized-bed reactor. Author (NSA)

N69-34413# Los Alamos Scientific Lab., N.Mex.
INTERNAL-CONVERSION ELECTRONS OF ANTIMONY-124
E. P. Grigorev et al 21 Mar. 1969 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR Ser. Fiz. (USSR), vol. 32, nos. 773-80, 1968
(LA-4085-TR) Avail: CFSTI

The conversion-electron spectrum of ^{124}Sb was studied with a magnetic β spectrometer. Measurement and stabilization of the spectrometer magnetic field were accomplished by the NMR method. The spectrometer was calibrated with the conversion electrons of ^{169}Yb. The level scheme for ^{124}Te was determined as well as internal conversion coefficients and multipolarities for γ transitions. NSA

N69-34435# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Material- und Festkoerperforschung.
INVESTIGATION OF THE COMPATIBILITY OF URANIUM MONONITRIDE WITH MOLYBDENUM TUNGSTEN, AND THORIUM OXIDE AT HIGH TEMPERATURE [UNTERSUCHUNGEN UEBER DIE VERTRAEGLICHKEIT VON URANMONONITRID MIT MOLYBDAEN, WOLFRAM UND THORIUMOXID BEI HOHEN TEMPERATUREN]
C. Politis, F. Thuemmler, and H. Wedemeyer Dec. 1968 20 p refs In GERMAN; ENGLISH summary
(KFK-885) Avail: AEC Depository Libraries

On annealing of uranium mononitride and UN–Mo mixtures on molybdenum supports above 2000°C under a vacuum of 10^{-2} to 10^{-5} torr an increase in the UN lattice parameter could be observed at room temperature. The decomposition of UN initiated at high temperatures under vacuum results in a γ–U–Mo phase, which can be detected by metallographic and X-ray methods. On the molybdenum supports UO_2 crystals oriented in [111] direction can be detected subsequent to annealings at 2400°C. X-ray studies on annealed UN–W specimens did not give indications on possible reactions or solubilities. Changes in the lattice parameters could not be observed. On annealing of UN–ThO_2 mixtures on tungsten and ThO_2 supports no remarkable change in the UN lattice parameter was detected up to 2400°C under 500 torr of nitrogen. On annealing supports of molybdenum a slight change of $\Delta a_0 = 0.005$ Å was measured following annealings at 1750 and 2000°C under vacuum. The temperature limit for satisfying compatibility strongly depends on the annealing atmosphere. Author (NSA)

N69-34450# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
MINIMUM CRITICAL U235 ENRICHMENT OF HOMOGENEOUS HYDROGENOUS URANYL NITRATE
S. R. Bierman and G. M. Hess Oak Ridge, Tenn. Oak Ridge Natl. Lab. Jun. 1968 34 p refs Prepared for Oak Ridge Natl. Lab.
(Contract W-7405-ENG-46)
(ORNL-CDC-5) Avail: CFSTI

A series of experiments with 2.14 and 2.26 wt% ^{235}U-enriched uranyl nitrate was performed in the Physical Constants Test Reactor to determine the minimum critical ^{235}U enrichment for homogeneous hydrogenous uranyl nitrate and to observe the reactivity effect of neutron moderation on these low enriched uranium materials. The minimum critical enrichment was determined to be 2.104 ± 0.010 wt % ^{235}U at an optimum H:U atomic ratio of 7.6. Optimum neutron moderation occurred, with k_∞ values of 1.013 and 1.04, at H:U atomic ratios of 8.0 ± 1.0 and 9.3 ± 0.5, respectively, for the 2.14 and 2.26 wt % enriched uranyl nitrate. Values of k_∞ greater than unity were observed for H:U ratios between 6 and 10.5 for the 2.14 wt % enrichment and between 4 and 15 for the 2.26 wt % enrichment. Author (NSA)

N69-34474# Mound Lab., Miamisburg, Ohio.
CONCENTRATION TO HIGH LEVELS OF HEAVY OXYGEN (O 18) BY THE THERMAL DIFFUSION METHOD
M. Yamamoto et al 1 Apr. 1969 28 p refs Transl. into ENGLISH from Nippon Kagaku Zasshi (Tokyo), no. 89, 1968 p 839–843
(Contract AT(33-1)-GEN-53)
(MLM-1643(tr)) Avail: CFSTI

Enrichment of O18 was carried out by using thermal diffusion columns with 1.0 to 3.0 atom % O18 oxygen gas as the starting material. The maximum O18 concentration attained was 80.8 atom % in 72 days with the apparatus of overall effective length 22.85 m (8 stages), and the transported amount was 2.6 ml ($^{18}O_2$)/day. With another apparatus of overall effective length 14.0 m (5 stages), the ^{18}O concentration attained was 69 atom % in 46 days, and the transported amount was 3.6 ml ($^{18}O_2$)/ day. By using the second apparatus, 150 ml of 60 atom % O18 oxygen gas or 250 ml of 25 atom %O18 oxygen gas could be obtained. Author (NSA)

N69-34502# Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry.
FLUORESCENCE EXCITATION AND QUENCHING IN AQUEOUS SOLUTIONS OF SALICYLATE UNDER ULTRAVIOLET AND IONIZING RADIATION
Gabriel Stein and Micha Tomkiewicz 25 Apr. 1969 162 p refs
(Contract AT(30-1)-3242)
(NYO-3242-30) Avail: CFSTI

Fluorescent light emitted from aqueous solutions of sodium salicylate under x irradiation originates from directly excited solute molecules. Excitation by energy transfer from solvent is absent in water. Therefore, processes in aqueous solutions are simpler than in organic ones. Fluorescence of the solute is quenched by radicals produced from the solvent by the radiation, enabling radical distribution to be studied at the nanoseconds level. Light emission was studied for 1×10^{-2} to 6×10^{-1} M solutions under x rays and up to 4 M under uv excitation. To interpret the results detailed comparison was made with quenching processes under uv. An NMR study of the structure in concentrated solutions was made to complete the interpretation. To coordinate results with those under ionizing radiations, existing models of the inhomogeneous distribution of radicals were critically surveyed and a one-radical model derived. This expanding sphere model gave the time dependence of radical concentration. Author (NSA)

N69-34504# Aerospace Corp., El Segundo, Calif. Lab. Operations.
HYDRAZINE COMPATIBILITY WTH ETHYLENE-PROPYLENE ELASTOMERS Research Report, Mar. 1968-Jan. 1969
Hideyo H. Takimoto and Genevieve C. Denault 28 Feb. 1969 20 p refs
(Contract F04701-68-C-0200)
(AD-688486; TR-0200(4210-10)-8; SAMSO-TR-69-153) Avail: CFSTI CSCL 11/10

The compatibility of several ethylene-propylene elastomers with hydrazine has been investigated. The gas evolution rate resulting from the catalytic decomposition of hydrazine by elastomers has been determined under ambient conditions. By varying the formulation of one ethylene-propylene rubber (EPR 132), we determined that the carbon black filler material in the elastomer is responsible for promoting the decomposition of the fuel. Author (TAB)

N69-34511# Central Electricity Generating Board, Bristol (England). Berkeley Nuclear Labs.
A STUDY OF THE REACTIONS BETWEEN INDIVIDUAL OXIDES FORMED DURING THE OXIDATION OF STAINLESS STEELS
W. H. Whitlow and J. H. Buddery Feb. 1969 20 p refs
(RD/B/N-1272) Avail: AEC Depository Libraries

Stability tests were made on the individual oxides of Fe, Ni, Cr, Mn, and Si at 1000°C and in a vacuum of 10^{-6} torr. Reactions between these oxides under similar conditions were also studied. The X-ray powder diffraction techniques were used to follow the course of the oxide/oxide reactions. Author (NSA)

N69-34525# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
QUANTITATIVE MIXED SOLVENT ANALYSIS BY INFRARED SPECTROPHOTOMETRY Final Report
Martha L. Adams May 1969 29 p
(AD-688588; CCL-264) Avail: CFSTI CSCL 11/11

The analysis of solvent mixtures to test their compliance with air pollution legislation by the use of infrared spectrophotometry is illustrated with specific recommended blends and hypothetical mixtures. Author (TAB)

N69-34526# Illinois Univ., Urbana. Coordinated Science Lab.
ELECTRON IMPACT DESORPTION OF IONS AND NEUTRALS FROM POLYCRYSTALLINE TUNGSTEN
Mitsuaki Nishijima Apr. 1969 144 p refs
(Contract DAAB07-67-C-0199)
(AD-688519; R-410) Avail: CFSTI CSCL 7/4

A cylindrical magnetic spectrometer has been constructed for the study of electron impact desorption of gases from solid surfaces. The instrument has been applied to the study of polycrystalline tungsten with O2, CO, H2, N2, CO2, and H2O adsorbed. The quantities which have been measured are: ion species desorbed, ion energy distributions, ionic and total desorption cross sections, and threshold energies. Measurements were also made on the kinetics of the adsorption-desorption processes and some measurements of thermal processes. The dependence on electron energy of the O(+) ion desorption cross section and total desorption cross section for O2/W indicates that the neutralization of ions is not the only but is a dominant mechanism for neutral desorption. Author (TAB)

N69-34595# General Electric Co., Schenectady, N.Y. Research and Development Center.
LEAD TELLURIDE RESEARCH PROGRAM Final Report
R. O. Carlson and L. F. Kendall Oct. 1968 62 p refs
(Contract AT(29-2)-2462)
(ALO-2462-9) Avail: CFSTI

Single-phase PbTe doped with sodium or iodine for high temperature thermoelectric power generation was synthesized in quartz tubes or in an autoclave pressurized with argon. The PbTe was hot-extruded into rods whose densities exceeded 98.5% of theoretical. Silver and samarium were tried as substitute dopants. Compatibility tests at 600°C for 1000 hours revealed that some module construction materials such as Lava and Fiberflax and metals like Ni, Mo, Te, and W did not alter the electrical properties of p-type thermoelements, whereas air, water vapor, Fe, Mn, Cr, and stainless steel were highly deleterious. Six life test cells were operated with couples held in a 210°-550°C gradient for thousands of hours. Mo or W provided a diffusion barrier at the hot end of the couples, but there was still a 3% to 8% degradation in power output over 1000 hour operation, arising mostly from an increase in the p-type thermoelement resistance. Author (NSA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-33204# Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
SPECTRAL CHARACTERISTICS OF A RADAR SIGNAL SCATTERED FROM A LARGE, IRREGULARLY SHAPED, ROTATING TARGET
Donald E. Barrick 1968 25 p refs Presented at USNC/URSI Fall Meeting, Boston, Sep. 9–11, 1968
(PB-182897) Avail: CFSTI CSCL 17/1

The average radar cross section and scattered signal spectrum are derived for a large, irregularly-shaped target whose aspect is changing with time. The perfectly conducting target surface is treated as a random variable and the analysis is based upon the physical optics integral; the development here is quite similar to that used in rough surface theory. Computer-generated curves are shown for the average radar cross section and signal spectrum assuming a Gaussian description of the target surface. The results should be helpful in predicting and analyzing the return from aircraft, missiles, reentry vehicles, satellites, and planets.
Author (USGRD)

N69-33209# Naval Research Lab., Washington, D.C.
A NEW NRL ACOUSTIC RESEARCH TANK FACILITY
Interim Report
J. Chervenak Feb. 1969 42 p refs
(AD-685198; NRL-6822) Avail: CFSTI CSCL 17/1

A new acoustic research tank facility designed for precise acoustic measurements on, and the study of, scaled models of sonar transducers, arrays, and related underwater devices has been installed at the Naval Research Laboratory. The tank is constructed of cypress wood, is 30 ft in diameter and 22 ft deep, and is enclosed in a cinder block house, which contributes to the maintenance of the controlled environment necessary for accurate measurements.
Author (TAB)

N69-33226# Sigmatron, Inc., Goleta, Calif.
ULTRA HIGH CONTRAST, SOLID STATE TELETYPE DISPLAY
E. J. Soxman and Henry J. Hebert Mar. 1969 46 p refs
(Contract Nonr-4509(00))
(AD-687740; JANAIR-690309; Rept-1001-201; TN-1) Avail: CFSTI CSCL 17/2

A design study is reviewed to demonstrate the feasibility of fabricating an all solid state alphanumeric display terminal. The visual display readout is achieved with a vacuum deposited, electroluminescent thin film structure incorporating an ultrahigh contrast, dark dielectric layer on a glass substrate. A modular design permits expandable display construction. As an example, a three-line display terminal is described with each line providing eighty alphanumeric characters. Individual characters are generated by the selective excitation of any combination of the individual electroluminescent elements in a 35 cell (5 × 7) rectangular matrix. The display panel case, approximately 4 inches high × 17 inches wide × 6 inches deep, accomodates discrete solid-state circuitry for switching the display. Additional peripheral control circuitry can be packaged in a separate chassis of approximately 2-1/2 cubic feet. Recent state-of-the-art improvements in both functional lifetime and brightness constrast indicate that thousand of hours of display readability can be expected even under ambient illumination of several hundred foot-candles.
Author (TAB)

N69-33229# Mitre Corp., Bedford, Mass.
NARROWBAND INTERFEROMETRY AND THE POLARIZATION SCATTERING MATRIX
H. S. Ostrowsky Dec. 1968 80 p refs
(Contract AF 19(628)-5165)
(AD-687103; MTR-743; ESD-TR-68-401) Avail: CFSTI CSCL 17/9

Two previous papers have described the concept and some of the applications of Narrowband Interferometry, using monostatic and multistatic radars (at small bistatic angles) to obtain two and three dimensional images of targets in terms of their scattering centers. The method involves taking finite Fourier transforms of measured narrowband amplitude and phase data to resolve individual scattering centers in Doppler at each radar site. The present paper extends these methods in two directions. The class of scattering centers considered is widened to include not only isotropic point scatterers as before but also point dipoles, as representatives of orientable scattering centers. The theory is broadened to involve the Polarization Scattering Matrix, so that the polarization behavior of the individual resolved scatterers can be determined as aids to their recognition.
Author (TAB)

N69-33253# Naval Research Lab., Washington, D.C. Communication Sciences Div.
A DIGITAL CONTROL SYSTEM FOR A REMOTELY LOCATED TRANSCEIVER PACKAGE
Kenneth A. Crayt Apr. 1969 22 p
(AD-687393; NRL-MR-1967) Avail: CFSTI CSCL 17/2.1

A digital control system for remotely controlling the electronic package of a towed submarine communications buoy was developed. It operates by sending binary bits serially to a receiving unit in the electronic package, each bit preceded by a synchronization pulse. The electronic package has employed latching relays, set by particular combinations of voltages appearing on the interconnecting lines, to control the mode of the unit. The digital system is superior to the relay system in that setting is automatic, it uses only one line for all control functions, it will indicate failure, and it is expandable; additional bits can be incorporated with little difficulty. Further, it promises greater reliability.
Author (TAB)

N69-33266*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE SCIENCES DIVISION
In its Supporting Res. and Advanced Develop. 30 Apr. 1969 p 42–66 refs (See N69-33263 19-31)
Copyright. Avail: CFSTI CSCL 17B

The following topics are discussed: (1) photogrammetric parameters for mapping imagery from orbiting television camera system and an infrared detection system for flight interferometry; (2) mathematical models for calculating atmospheric and structural properties of the moon and planets; and (3) stability analyses on boundary layer transitions and reaction rates during photolysis of carbon dioxide.
G.G.

N69-33267*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TELECOMMUNICATIONS DIVISION
In its Supporting Res. and Advanced Develop. 30 Apr. 1969 p 78–118 refs (See N69-33263 19-31)
Copyright. Avail: CFSTI CSCL 17B

Various coding and decoding models are studied for high rate telemetry data generation. Spacecraft antenna research centered on the design of a linearly polarized multimode monopulse primary

feed and an analysis of entry wake effects on the radiation from a turnastile antenna. Also discussed are optimization procedures for the performance of a digital data transition tracking loop with fixed power constraint and the effects of loop stress on phase coherent communications. G.G.

N69-33304*# Kansas Univ., Lawrence. Engineering Science Div.
A STUDY OF HIGH PERFORMANCE ANTENNA SYSTEMS FOR DEEP SPACE COMMUNICATION Status Report, 15 Nov. 1968–15 Jun. 1969
15 Jun. 1969 79 p refs
(Grant NGR-17-004-013)
(NASA-CR-103816; SASR-3) Avail: CFSTI CSCL 17B

Parameters for a high data rate of communication system which can operate between an earth station and a vehicle in space over great distances is studied. The characteristics of radiating subsystems and their internal sub-divisions which can satisfy the requisite performance criteria for an S-band system are described. Considerations are given to the advance technology concerned with the ground based antenna, and where pertinent, to the spacecraft antenna as well. Feasible design approaches for the ground antennas and its component parts are determined. The ground-based antennas are discussed as components of a link designed to fulfill the specific function of providing uninterrupted communication from a spacecraft to the earth at planetary distances. For obvious reasons, the most attention is given the down link aspects using a carrier frequency of 2.3 GHz, since a frequency in this region has advantages for an all-weather ground station and is presently in use in the NASA Deep Space Instrumentation Facility. Author

N69-33425*# ADCOM, Inc., Cambridge, Mass.
STUDY OF A MULTIPATH REJECTION TECHNIQUE APPLIED TO AIRCRAFT NAVIGATION BY SATELLITE Final Report
R. Wachsman, H. Salwen, L. Klein, and R. Zaorski 15 Mar. 1969 218 p refs
(Contract NAS12-567)
(NASA-CR-86190) Avail: CFSTI CSCL 17B

The effects of multipath interference on a navigation satellite ranging receiver for the case where the range modulation signal consists of a BINOR ranging code directly phase modulating a 1.6 GHz carrier is investigated. The design of an alternate ranging modulation and receiver which is capable of improved (and optimized) performance is also presented, along with the suitability of the steerable null technique developed to multipath rejection in the 1.6 GHz multipath channel. Author

N69-33427*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AUDIO SIGNAL PROCESSOR
Robert Lee Hymer, inventor (to NASA) Filed 8 Jul. 1969 13 p
(NASA-Case-MSC-12223-1; US-Patent-Appl-SN-839941) Avail: CFSTI CSCL 07B

A circuit has been developed for maintaining a relatively constant audio output signal level to interface equipment. A voice operated switch operates a variable attenuator coupled to an automatic volume control (AVC) to prevent background noise surge during speech pause. The output signal from a microphone is fed through a preamplifier to a variable attenuator and then to the AVC circuit. A voice operated switch is connected between the output of the microphone preamp and the attenuator and activates the latter when the output signal from the preamp falls below a predetermined minimum amplitude to introduce signal attenuation at the same rate as gain is increased in the automatic volume control circuit. This eliminates noise surges during periods of silence or low amplitude input into the microphone. NASA

N69-33550# Technische Hochschule Munchen (West Germany).
THEORETICAL AND EXPERIMENTAL STUDIES OF THE NEAR FIELD OF A CYLINDRICAL TRANSMITTER ANTENNA WITH INTEGRATED CONCENTRIC ELEMENTS [THEORETISCHE UND EXPERIMENTALLE UNTERSUCHUNGEN DES NAHFELDES EINER ZYLINDRISCHEN SENDEANTENNE MIT EINGEBAUTEN KONZENTRIERTEN ELEMENTEN]
Volker Stein (Ph.D. Thesis) 1969 23 p refs In GERMAN
Avail: CFSTI

Current distribution and the near field of cylindrical and symmetrically constructed antennas were investigated. All characteristics of an ohmically loaded transmitter antenna were calculated, particularly the field conditions and the energy currents. A formula was established for the required boundary condition on the antenna surface, taking into account the finite widths of feeder and loading slots. Field line diagrams and the corresponding points of an analyzed area were derived by computer. The calculated antenna fields were verified by measurements. Transl. by K.W.

N69-33557*# General Electric Co., Philadelphia, Pa. Missiles and Space Div.
TELEVISION BROADCAST SATELLITE (TVBS) STUDY, VOLUME 1 Summary Report
R. W. Hesselbacher 1 Aug. 1969 44 p
(Contract NAS3-9708)
(NASA-CR-72578) Avail: CFSTI CSCL 17B

The results of a study of technological and cost factors associated with TV broadcast satellite systems are presented. The cost and performance of the ground and space segments of the system are evaluated as a function of varying the parameters of transmission frequency, modulation, TV picture quality, audience size, size of coverage areas, indigenous noise, and ground receiving modification costs. Satellite conceptual designs are described based upon technology estimates for the early 1970's. Cost comparisons are made with terrestrial methods of delivering transmissions. Significant broadcast satellite technology items are identified and ranked in order of importance, and the following conclusions are made: broadcast satellites are feasible, cost effective, and capable of achieving turnkey operations sooner than terrestrial systems. Author

N69-33564# Stanford Research Inst., Menlo Park, Calif.
A STUDY OF ELECTROMAGNETIC PROPERTIES OF AN ISOLATED TREE Special Technical Report No. 41
Vichit Lorchirachoonkul Feb. 1969 96 p refs
(Contract DA-36-039-AMC-00040(E); ARPA Order 371)
(AD-687298) Avail: CFSTI CSCL 17/2.1

The objective of the report is to establish an electrical model to represent an isolated tree. Representation of an isolated tree by a perfectly conducting cylinder of smaller radius is shown to be feasible. This leads to the concept of using the equivalent radius of the tree to link the unknown electromagnetic theories of the tree to the well-developed theories of the perfectly conducting cylinder. Data from three kinds of experiments are analyzed to validate the electrical model: (1) Patterns of radio waves scattered from an isolated tree and from an aluminum mast, (2) Input impedance of a 1/2 wavelength vertical antenna in the vicinity of an isolated tree, and (3) Patterns of an isolated tree as a shunt-fed, grounded radiator. The frequencies used in the experiments were 50, 75.1, and 100 MHz; the polarization was vertical. The variation of the input impedance of a 1/2 wavelength vertical antenna as it is moved close to a tree trunk that is similar to that of a 1/2 wavelength horizontal antenna as it approaches a lossy ground. The directivity of a tree as a shunt-fed, grounded radiator is demonstrated experimentally, and the front-to-back ratio is about 18 dB. Author (TAB)

N69-33618# Technische Hochschule Munchen (West Germany).
CALCULATION OF WAVE FIELDS IN RECTANGULAR WAVEGUIDES WITH CROSS SECTION DEFORMATIONS HAVING LOW-PASS PROPERTIES AND BLOCKING POINTS OF A HIGH ORDER [BERECHNUNG VON WELLENFELDERN IN RECHTECKHOHLLEITERN MIT QUERSCHNITTSVERFORMUNGEN, DIE TIEFPASSEIGENSCHAFTEN ZEIGEN UND SPERRSTELLEN HOEHERER ORDNUNG AUFWEISEN]
Joschim H. Ziemann (Ph.D. Thesis) 1968 22 p refs In GERMAN
Avail: CFSTI

Approximative calculations on the wave field in a hollow guide with low pass cross section deformations are reported. Calculations for a series of narrowing-expanding-narrowing wave propagation between the semicircular indentations show the development of electromagnetic eddies and the simultaneous formation of three energy eddies at blocking points. Transl. by G.G.

N69-33634# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
AN INTERPRETER'S PERSPECTIVE ON MODERN AIRBORNE-RADAR IMAGERY
Richard B. Innes *In its* Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 107-122 (See N69-33626 19-14)
Avail: CFSTI

A general survey of airborne-radar imagery technology is presented. Topics covered include specifications of radar waves, antennas, synthetic aperture radar, stereoscopic radar, and directions of current research. K.R.G.

N69-33641# Kansas Univ., Lawrence. Dept. of Geography.
THE USE OF RADAR IN THE DISCRIMINATION AND IDENTIFICATION OF AGRICULTURAL LAND USE
David E. Schwarz and Fred Caspall *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 233-247 refs (See N69-33626 19-14)
(Contract USGS-14-08-0001-10848)
Avail: CFSTI

Radar imagery, because it may be obtained through cloud cover, at night, and over large areas as desired, can provide valuable data for agricultural land use mapping. It appears that normal variations in soil or crop moisture are much subordinant to the unique combination of gross plant geometry, microroughnesses, and other inherent properties particular to each crop type. Since it is the kind of crop which most influences radar return, discrimination by crop type is feasible. The two universes, cropped and uncropped agricultural land, are usually separable on K band radar imagery. Further distinctions by crop type can be made with varying probability. Combined information from multiple polarized images or imagery collected at more than one time in the growing season greatly enhances the probability for correct crop identification. These several data sets are readily reduced to clusters comparing favorably to crop type categories. Both numerical cluster analysis and electronic data combining techniques are used. Author

N69-33688# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
RADAR AS A TOOL IN METEOROLOGY, ENTOMOLOGY AND ORNITHOLOGY
T. G. Konrad *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 655-665 refs (See N69-33626 19-14)
Avail: CFSTI

Experiments with high-power, narrow beam radars have shown that electromagnetic radiation is scattered sufficiently by the irregularities in the refractive index of the air to use radar as a probe to investigate the structure of the optically clear atmosphere. Clear-air structures such as convective cells, thin horizontally stratified layers, breaking gravity waves, the sea breeze, and layers in the vicinity of the tropopause are easily recognizable and were studied. Aircraft probes of the high altitude layers have shown that these layers are turbulent indicating the use of ground based radars as clear air turbulence detectors. Some experiments relating to dot angel radar returns involved tracking of known, single birds and insects in flight. Author

N69-33689# Army Cold Regions Research and Engineering Lab., Hanover, N.H. Photographic Interpretation Research Div.
REMOTE SENSING FOR ENGINEERING INVESTIGATION OF TERRAIN RADAR SYSTEMS
R. D. Leighty *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 669-685 refs (See N69-33626 19-14)
Avail: CFSTI

The present and future potential of radar for engineering investigation of terrain is discussed. The purpose is to acquaint the engineer with the applicable radar literature pertaining to radar uses, radar systems, radar theory and emperical measurements, qualitative analysis of radar imagery, and miscellaneous radar techniques. Author

N69-33789# Michigan Univ., Ann Arbor. Computer Information and Control Engineering.
ON THE CALCULATION OF MUTUAL INFORMATION
Tyrone E. Duncan 1968 13 p refs
(Grant AF-AFOSR-814-66)
(AD-686819; AFOSR-69-1112TR) Avail: CFSTI CSCL 9/4

Calculating the amount of information about a random function contained in another random function has important uses in communication theory. An expression for the mutual information for continuous time random processes has been given by Gelfand and Yaglom, Chiang, and Perez by generalizing Shannons result in a natural way. Under a condition of absolute continuity of measures the continuous time expression has the same form as Shannons result. For two Gaussian processes Gelfand and Yaglom express the mutual information in terms of a mean square estimation error. We generalize this result to diffusion processes and express the solution in a different form which is more naturally related to a corresponding filtering problem. We also use these results to calculate some information rates. Author (TAB)

N69-33814# Pennsylvania State Univ., University Park. Radio Astronomy Observatory.
THE PENNSYLVANIA STATE UNIVERSITY RADIO ASTRONOMY OBSERVATORY STUDY OF MILLIMETER PROPAGATION IN THE EARTH'S ATMOSPHERE Final Report, Oct. 1965-Oct. 1968
Louis Winkler Nov. 1968 66 p refs
(Contract DA-18-001-AMC-905(X))
(AD-687391) Avail: CFSTI CSCL 20/14

The purpose of the work relating to this report is to study the propagation characteristics of millimeter waves in the earths atmosphere. One method used to accomplish this was to make measurements of the radiation of the sun and atmosphere together, and the atmosphere alone. These measurements were made with a 36 GHz radiometer. Other methods were to reduce and analyze data supplied by the technical monitor and develop some related

theoretical ideas. A variety of absorption and emission statistics of the atmosphere have been acquired at 36 GHz. From these data certain propagation characteristics have been specified, some of these relate to meteorological factors. Certain solutions and possible solutions were suggested for the data problems supplied by the technical monitor. Specific theoretical ideas were developed for future use in investigations. Author (TAB)

N69-33859# Joint Publications Research Service, Washington, D.C.
METHOD FOR COMPENSATING AMPLITUDINAL FLUCTUATIONS OF A SIGNAL REFLECTED FROM A FLIGHT VEHICLE
I. V. Baryshev 30 Jul. 1969 3 p refs Transl. into ENGLISH from Samoletostroyenie i Techn. Vozdushnogo Flota (USSR), no. 13, 1968 p 39–43
(JPRS-48512) Avail: CFSTI

An attempt is made to increase the accuracy of determining target angular coordinates. The radiation pattern of a radar station antenna was used in the procedure. Two receiving channels were used to determine the coordinates in the low frequency field. The high frequency field was found to be not as accurate. Logarithmic amplifiers were also used. Results show that accuracy was not significantly increased for the angular coordinates. E.H.W.

N69-33943# Royal Aircraft Establishment, Farnborough (England).
A REPORT OF RAE TRIALS ON VHF COMMUNICATION BY TROPOSPHERIC PROPAGATION BETWEEN A FIXED GROUND STATION AND AN AIRCRAFT FLYING BEYOND THE HORIZON
H. L. Spong Sep. 1968 43 p refs
(RAE-TR-68224/UL) Copyright. Avail: CFSTI

The essential features of the flight plans and equipment used in the experiment are described. Typical results of signal strength, fading and transmitted data by F.S.K. modulation are shown. The results of a statistical analysis indicate that although fade depths of 20 dB were observed, a high flying aircraft using a system gain as in this experiment could expect to receive correctly at 200 nm beyond the optical horizon of the ground station, 95 percent of all digits transmitted without resort to error correcting techniques. Author

N69-34014# Naval Weapons Lab., Dahlgren, Va.
ATTENUATION OF RADIO WAVES IN THE 2-32 MHz RANGE BY A PLANE EARTH OF FINITE CONDUCTIVITY
Edward L. Price Feb. 1969 31 p refs
(AD-687418; NWL-TR-2277) Avail: CFSTI CSCL 20/14

The attenuation of radio frequency waves traveling along the surface of finitely conducting earth is computed. Vertical polarization and a flat earth are assumed. Results are shown in graphical form. One set of graphs shows the electric field intensity produced by a short monopole antenna as a function of distance from the antenna. Another set shows the attenuation of a vertically polarized wave as a function of distance for any antenna. Four different sets of typical ground constants were used for the computations. The computations are based on a slightly modified form of Nortons equations. The modifications are shown in an appendix. Author (TAB)

N69-34078# Forsvarets Forskningsanstalt, Stockholm (Sweden).
SOME REMARKS CONCERNING TWO FORMALLY DIFFERENT WAYS OF TREATING WAVE PROPAGATION IN INHOMOGENEOUS W-WAVE MEDIA
Staffan Hoeijer Oct. 1967 12 p ref
(FOA-2-A-2501-55) Avail: CFSTI

As an introduction to the study of an inhomogeneous n-wave medium a homogeneous medium is considered. The inhomogeneous case is treated formally in two different ways, the P-method and the T-method. After describing and comparing these methods, the solutions are related to those of the homogeneous case. Author

N69-34118# Chain Lakes Research Associates, Inc., Detroit, Mich.
DOPPLER VOR SIDEBAND ANTENNA MONITOR Final Report
Z. I. Szewczyk Jan. 1969 28 p
(Contract FA-66-WA-1489)
(AD-687404; SRDS-RD-69-7) Avail: CFSTI CSCL 17/7

Two prototype Doppler VOR Sideband Antenna Monitor units were developed to Engineering Requirement FAA ER 330-004. The Monitor senses the failure of the Doppler VOR antenna elements by the presence of spurious modulation on the 9960 Hz sideband signal. Failure (open or short) of one or more antenna elements results in generation of harmonics of the 30 Hz reference modulation on the 9960 Hz FM subcarrier. These harmonics exist predominately in the 200 to 600 Hz range. The radiated signal was originally to be received by the Field Detector Antenna and examined for spectral purity by the Monitor, with alarm actuated when the amount of 30 Hz harmonics exceeded a predetermined amount. The monitor also incorporates a self-check function which superimposes a partial simulated failure signal on the 9960 Hz sub-carrier. This provided continuous check of the Monitor operation. Tests of the delivered equipment indicated reliable detection of the antenna open and shorted condition. An alternate self-check configuration was proposed by the contractor and delivered for evaluation. This configuration permits a significant cost reduction and performed as well as the original configuration. Author (TAB)

N69-34202# Army Foreign Science and Technology Center, Washington, D.C.
TRANSMISSION OF VOCODER SIGNALS OVER SMALL CAPACITY BINARY CHANNELS
V. I. Kulya May 1969 12 p Transl. into ENGLISH from the book "Vsesoyuznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio (no. 22): Sektsiya Provodnoi Svyazi" Moscow, 1968 p 48–52
(AD-687895; FSTC-HT-23-48-69) Avail: CFSTI CSCL 17/2

With a fixed capacity of a binary channel, reduction of intelligibility of synthesized speech due to lowering the frequency of discretizing within certain limits is compensated for by increasing the number of binary digit bits which represent the levels of the signal parameters, however, reducing the frequency of discretization to values below 40 Hz led to irreversible losses in speech intelligibility. The introduction of a logarithmic scale of quantification levels of signal parameters a sub 1 – a sub 8 while maintaining an assigned fixed speech intelligibility level permits the capacity of a binary channel to be reduced approximately two times in comparison with the capacity required with an equivalent scale of levels (i.e., without using blocks LC and E). With a channel capacity of less than 1,500 bits per second it is more expedient to eliminate signal parameter a sub 8 and thus increase the accuracy of transmitting the remaining signal parameters. The qualitative indexes of the synthesized signal are almost completely maintained when transmitting along a binary channel having a capacity of the order of 2,500 bits per second. The maximally-admissible channel capacity, corresponding to an intelligibility level of sound combinations of 70%, is (without transmitting the base tone) 1,000 bits per second. Author (TAB)

N69-34206# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
ANALYSIS AND SIMULATION OF CASCADED PHASE LOCKED LOOPS Interim Technical Report
John Joseph Stein Mar. 1969 98 p refs
(Grant DA-ARO(D)-31-124-G929)
(AD-688651; USCEE-336; AROD-7198-5-RT) Avail: CFSTI CSCL 17/2.1

In practice obtaining precise velocity of a space probe requires a two way coherent communication link. This type of system which involves two phase locked loops (P. L. L) in cascade simultaneously transmits information from the ground to the vehicle and back again. The study addresses itself to finding the steady state (module 2 pi) joint probability density function for both the output phases and phase errors of the cascaded P. L. L. The required density function is the solution of the steady state Fokker Plank equation (modulo 2 pi) for the cascaded P. L. L. system. However, an exact solution of this partical differential equation does not appear possible since indeed exact solutions have not been forthcoming for the simpler version of the studied system. Therefore, an approximate analytic representation of the required density functions is postulated. The parameters of this representation are given as functions of the cascaded P. L. L. system model parameters.
Author (TAB)

N69-34389# RAND Corp., Santa Monica, Calif.
THE PROMISE OF UHF SATELLITES FOR MOBILE, BROADCAST AND LOW-COST SERVICES AND RELATED NEW COMMUNICATIONS ALLOCATIONS, OPERATIONS, AND POLICIES
J. L. Hult May 1969 48 p refs Presented at Joint Natl. Meeting of the AAS and ORSA on Planning Challenges of the 70's in Space and Public Domain, Denver, 17–20 Jun. 1969
(AD-688481; P-4071) Avail: CFSTI CSCL 17/2

The paper treats a variety of important controversial telecommunication issues of public, private and governmental concern. Revolutionary technological developments are confronting the traditional administrations with problems beyond their scope of efficient solution. There is a need for new policy and regulation approaches to insure a more orderly, beneficial exploitation of the technological potential. Prominent current issues include a variety of possible satellite relay applications, the spectrum needs of mobile services, and competing TV broadcast approaches. Author (TAB)

N69-34420# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RECOGNITION OF SPOKEN WORD ENSEMBLES WITH THE AID OF A DIGITAL COMPUTER
V. N. Trunin-Donskii et al Feb. 1969 22 p refs Transl. into ENGLISH from Vychislitel'nyy Tsentr. Raboty Po Tekhn. Kibernetike (USSR), 1967 p 37–61
(AD-687227; FTD-MT-24-442-68) Avail: CFSTI CSCL 17/2

It is shown that the attributes of speech, which are naturally related to differential attributes of phonemes, articulation and, particularly, acoustic features, must be affected to a much smaller extent than the speech signal itself by the features of individual human pronunciation and partly also by context. Then the speech signal is construed as consisting of a number of segments, each characterized by one or several attributes such as the presence of fundamental tone, the noise component (high density of zeros), etc. The introduction of segments facilitates the computer recognition of speech since then a spoken word can be broken down into a sequence of segments, recognizable on a probabilistic basis. In this connection, certain attributes of speech signals were experimentally investigated by having 20 speakers of both sexes pronounce 10 letters of the Cyrillic alphabet each. The attributes of the sound signal were isolated on the basis of time-frequency pattern matching and represented in binary form. TAB

N69-34486# Coast Guard, Alexandria, Va. Washington Radio Station.
ATS SATELLITE COMMUNICATIONS TESTS. VHF SHIPBOARD TESTS ON US COAST GUARD CUTTER STATEN ISLAND. VHF SHIPBOARD TEST ON US COAST GUARD CUTTER GLACIER. VHF SHIPBOARD TESTS FROM OCEAN STATION BRAVO. VHF SHIPBOARD TESTS FROM OCEAN STATION DELTA Final Reports, 29 Apr. 1968–17 Feb. 1969
Joe N. Ware and Michael R. Johnson May 1969 235 p refs
(AD-687978) Avail: CFSTI CSCL 17/2.1

This report is a summary of results obtained from the ATS-1 VHF tests conducted on board the USCGC STATEN ISLAND during the period from 19 July 1967 - 23 October 1967. The STATEN ISLAND was operating in the region from Seattle, Washington to the Chukchi Sea (north of Alaska). Author (TAB)

N69-34592# Texas Instruments, Inc., Austin. Government Products Div.
EFFECTS OF MASKING VOICES ON THE APPREHENSIBILITY OF SIX CONSONANT ATTRIBUTES
William D. Voiers 1 May 1969 40 p refs
(Contract AF 19(628)-5883)
(AD-687753; TRACOR-69-475-U; AFCRL-69-0157; SR-1) Avail: CFSTI CSCL 17/2

The Diagnostic Rhyme Test was used to investigate the effects of continuous speech maskers upon the apprehensibility of six elementary attributes of consonant phonemes. It was found that speech maskers have a qualitatively unique effect, the nature of which is generally consistent with predictions based on the temporal and spectral properties of speech maskers. Individual differences in susceptibility to masking were also investigated. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-33257# Army Nuclear Defense Lab., Edgewood Arsenal, Md.
A GENERAL NON-LINEAR LEAST SQUARES DATA FITTING PROGRAM
David Vogt and A. R. Buhl Apr. 1969 53 p refs
(AD-687276; NDL-TM-55) Avail: CFSTI CSCL 9/2

The paper describes a general non-linear Least Squares Program (LSP). LSP will accept as many as 200 data values and will fit these data with any equation that conforms to the following criteria: is continuously differentiable; is a function of 5 or less independent variables; is linear or non-linear; and has twenty, or less, fitting parameters. In accordance with certain convergence criteria, the program calculates the values of the fitting parameters for which the given equation best fits the input data. The associated variances are calculated per data point and per fitting parameter. The program is written in FORTRAN IV and requires three tape drives and a 16K memory. Author (TAB)

N69-33280*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MIDCOURSE MANEUVER PROGRAM
R. T. Mitchell *In its* The Mariner 5 Flight Path and its Determination from Tracking Data 1 Jul. 1969 p 46–47 refs (See N69-33276 19-30)
Avail: CFSTI CSCL 09B

The computer program used in real-time operations to determine the maneuver parameters, known as the Midcourse

Maneuver Operations Program, is presented. The five operational blocks of the program are: introductory printout, midcourse decision program, command generation program, plotting program, and capability ellipse generator. P.O.S.

N69-33311*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAMPLED DATA CONTROLLER
James A. Gatlin, inventor (to NASA) Filed 29 May 1968 46 p
(NASA-Case-GSC-10554-1; US-Patent-Appl-SN-828984) Avail: CFSTI CSCL 09B

This feedback controller samples error signals within a single control formulation time interval. The error signals are derived by comparing the response of a plant with a reference input, constant over the interval, in a servo subtraction node. Each of the sampled errors is applied to an accumulator with a weighting factor, having a value selected on a predetermined basis, determined by the plant characteristics, to provide finite plant settling time. At the end of each control formulation interval the previous output of the accumulator is fed back to the accumulator through a weighting factor network. The output of the accumulator at the end of each formulation interval is applied as a control input to the plant. An application is mentioned in which the plant is a spin stabilized, attitude controlled satellite. NASA

N69-33315# Joint Publications Research Service, Washington, D.C.
COMPUTER TECHNIQUES IN BIOLOGICAL RESEARCH
11 Jun. 1969 22 p refs Transl. into ENGLISH from the book "Avtomatizatsiya Biologicheskikh Issledovaniy" Moscow, Nauka Press, 1968 p 98–107, 157–160
(JPRS-48208) Avail: CFSTI

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1. NEURON-1: A STATISTICAL ANALYZER OF BIO-ELECTRIC POTENTIALS B. N. Boyko, Yu. G. Ivanchenko, V. V. Kornikov, Ye. N. Kuznetsov, A. O. Plotkin et al p 1–7 (See N69-33316 19-08)

2. BIOCODE-1: A BIO-ELECTRIC POTENTIAL CONVERTER V. S. Golichenkov, V. K. Kudryashov, A. A. Shirogorov, and N. M. Shmakova p 8–12 refs (See N69-33317 19-08)

N69-33316# Joint Publications Research Service, Washington, D.C.
NEURON-1: A STATISTICAL ANALYZER OF BIO-ELECTRIC POTENTIALS
B. N. Boyko, Yu. G. Ivanchenko, V. V. Kornikov, Ye. N. Kuznetsov, A. O. Plotkin et al *In its* Joint Publ. Res. Serv. 11 Jun. 1969 p 1–7 (See N69-33315 19-08)
Avail: CFSTI

Foreign statistical analyzers for biological research and their application in information processing systems and automation of experimentation are investigated. The basic requirements are discussed. A brief technical description and block diagram of the Neutron-1 biopotential analyzer is presented. Author

N69-33317# Joint Publications Research Service, Washington, D.C.
BIOCODE-1: A BIO-ELECTRIC POTENTIAL CONVERTER
V. S. Golichenkov, V. K. Kudryashov, A. A. Shirogorov, and N. M. Shmakova *In its* Joint Publ. Res. Serv. 11 Jun. 1969 p 8–12 refs (See N69-33315 19-08)
Avail: CFSTI

The block diagram of the voltage code and time interval code converter of an all prupose complex of scientific electrophysiological equipment is described, and the technical specifications of the instrument are given. Author

N69-33376*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CODING: AN ENGINEERING TOOL FOR THE DIGITAL TELEMETRY LINK
Ronald M. Muller Aug. 1969 15 p refs
(NASA-TM-X-63623; X-562-69-311) Avail: CFSTI CSCL 09B

Various digital coding techniques are discussed from an engineer's and user's point of view. Each technique is displayed in a uniform way which measures performance against the best possible (Shannon) channel. Encoding–decoding complexity and other "system" merits and drawbacks of each technique are discussed. The reader is introduced to coding by drawing analogies with an everyday and familiar coded communication channel–spoken English. Bit, word and block error detection and correction techniques are then presented. Lastly, a concatenated block code scheme which combines these techniques is developed. Author

N69-33428*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
AN INTERFACE FOR A REAL-TIME STORAGE OSCILLOSCOPE DISPLAY
Robert Arnold Berntson (B.S. Thesis) Jun. 1969 40 p refs
(Contract NAS5-11062; Grant NGL-22-009-019)
(NASA-CR-103817; MIT-CSR-T-69-3) Avail: CFSTI CSCL 09B

A small general purpose digital computer is to be used in a laboratory environment for the monitoring, calibration, and checkout of a satellite experiment package. Test results are to be presented via printout and graphics. The existing real time graphics system consists of a small general purpose computer and an incremental X-Y plotter, with an appropriate software and hardware interface. A new interface has been designed to provide for the addition of a storage oscilloscope display to this system. It is shown that scope writing using unresolved dots is operationally equivalent to plotter writing using incremental steps. Functional graphical equivalence of the two devices is then established through the use of adapted plotter software for the operation of either device. Author

N69-33554# Road Research Lab., Crowthorne (England).
AUTOMATIC DATA-RECORDING FOR THE LABORATORY CONSOLIDATION TEST
M. J. Irwin 1968 20 p ref
(RRL-LR-188) Avail: CFSTI

To provide more consistent test results and to minimize the effort involved, the laboratory has developed a data-logging system to record the measurements obtained from the oedometer. The compressions occuring are measured by displacement transducers and recorded on punched paper tape for subsequent analysis by computer. For 24-hour tests under controlled laboratory conditions the overall accuracy of the system will generally be of the order of ± 0.015 mm (± 0.0006 in.) or better. Author

N69-33889*# International Business Machines Corp., Yorktown Heights, N.Y. Watson Research Center.
A FORMAL THEORY OF CUBICAL COMPLEXES Formal Report, 1 Sep. 1968–30 Apr. 1969
J. Paul Roth, E. G. Wagner, and G. R. Putzolu May 1969 48 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952341)
(NASA-CR-103840) Avail: CFSTI CSCL 09B

A heuristic algorithm C-alg for the computation of tests for failures in sequential or cyclic circuits is described. Illustrations of the operations of the D and C-algorithms are given along with a description of the models used. An algorithmic language, F-notation is given for the C-logrithm. Brief comments concerning the efficiency of the algorithm are made. Author

N69-33891# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.

PROGRAMMER'S MANUAL: UCARDS UNION CARBIDE AUTOMATIC ROUTING AND DESIGN SYSTEM FOR PRINTED CIRCUIT BOARDS

J. F. Jamison 30 Apr. 1969 299 p refs

(Contract W-7405-ENG-26)

(CTC-4) Avail: CFSTI

UCARDS is a computer aided design system for producing component layout, conductor layout, and other aids to the fabrication of printed circuit boards. This manual is intended to be a guide for implementing and maintaining the system. Author (NSA)

N69-33777# Army Tank-Automotive Center, Warren, Mich. Management and Data Systems Directorate.

CATALOG OF COMPUTER TIME: SHARING PROGRAMS RELEVANT TO OPERATIONS RESEARCH (MANAGEMENT SCIENCE)

Irwin F. Goodman May 1969 19 p refs

(AD-688049; S-1007) Avail: CFSTI CSCL 9/2

A catalog of Computer Time-Sharing Programs relevant to Operations Research and Management Science and indexed to facilitate finding programs with particular problem solving characteristics has been compiled. The purpose of the catalog is to encourage and facilitate the use of the computer time-sharing terminal for solution of Operations Research and Management Science types of problems. Author (TAB)

N69-33778# Army Tank-Automotive Center, Warren, Mich. Management and Data Systems Directorate.

M JOB: ONE MACHINE SEQUENCING PROBLEM Final Report

Irwin F. Goodman May 1969 30 p refs

(AD-688046; S-1003) Avail: CFSTI CSCL 9/2

The M job one machine sequencing problem is solved by use of J. M. Moores Algorithm. The Algorithm has been programmed in Basic language on a computer time sharing terminal. An example of a computer run along with the computer program and flow diagram are included. This effort was accomplished in support of a currently larger effort concerning the scheduling of jobs on a computer. Author (TAB)

N69-33849# Bradford Univ. (England).

NARROW BAND PROPORTIONAL SAMPLED DATA CONTROL OF SYSTEMS WHICH INCLUDE DEAD TIME

G. Calvert 13 May 1969 18 p refs

Avail: CFSTI

There are many applications in the process field where the use of narrow band proportional control is advantageous. This analysis determines, for any particular form of desired response, the values of loop gain and sampling period that should be used, the gain being the optimum value for the particular system under consideration. For any system, there is a maximum value of gain for various combinations of process parameters in the chosen model and the design method suggested gives this maximum. Author

N69-33857# Air Force Cambridge Research Labs., Bedford, Mass.

DIGITAL DATA PROCESSING IN IONOSPHERIC SOUNDING

R. W. Gowell, K. Bibl (Lowell Tech. Inst.), J. Buchau (Lowell Tech. Inst.), and B. W. Reinisch (Lowell Tech. Inst.) Dec. 1968 64 p refs

(Contract AF 19(628)-4801)

(AD-687086; AFCRL-68-0664) Avail: CFSTI CSCL 9/2

Data collection in the field of environmental science using analog methods has become highly problematic due to the immense information density of most measurements. One possible solution to this problem is the selection of parameters prior to the recording of the data. Certain aspects of the proposed solutions, as well as modern data analysis methods, require preprocessing and digital recording of the information. A sounding system comprising an airborne granger 3905-1 ionospheric sounder and a pulse amplitude digitizer uses the approach of parameter selection. Up to six arbitrarily selected frequencies can be monitored simultaneously; one ionospheric echo per frequency can be gated out and recorded in digital form on tape. This system together with automatic calibration is the ideal basis for multi-frequency absorption and drift measurements. As a part of an airborne ionospheric laboratory, this equipment has been successfully used for absorption measurements during two eclipse expeditions, for investigations of the South Atlantic magnetic anomaly, and for the study of the influence of the albedo on the D-region ionization. Further experiments such as the study of ionospheric irregularities and the ground reflectivity are considered. Author (TAB)

N69-33888# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.

A STUDY OF DIGITAL ENCODING SYSTEMS Annual Scientific Progress Report No. 1, 1 Sep. 1968 – 1 Apr. 1969

John B. O'Neal, Jr. 1 Apr. 1969 167 p

(Contract F44620-69-C-0033)

(AD-688606; AFOSR-69-1383TR) Avail: CFSTI CSCL 9/4

The research program is designed to accomplish two primary objectives: (1) to obtain a basic understanding of the digital encoding processes and to derive an optimum digital encoding algorithm under certain general conditions and (2) to determine explicitly what kinds of practical digital encoding equipment should be used for the various tasks which require it. TAB

N69-33894# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.

AN INDICATION UNIT WITH A STORAGE OSCILLOGRAPH FOR THE ToVM (MINSK-2 DIGITAL COMPUTER)

A. P. Meshchanin 1968 13 p refs In RUSSIAN

(IFVE-SEF-68-45-K) Avail: AEC Depository Libraries

An indication unit with a storage oscillograph Type C1-37 for fast transfer of the information from the digital computer is described. The device was designed for visual observation of on-line physics experiments. Author (NSA)

N69-33926# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

A NOTE ON THE ECASAC PROGRAM [NOTE SUR LE PROGRAMME ECASAC]

Daniel Bras Mar. 1969 27 p In FRENCH; ENGLISH summary

(CEA-R-3768) Avail: CFSTI

The analytical program developed by IBM for ECAP electronic circuits, operated initially on the IBM 1620 computer with a certain limitation on the size of the network studied, was already equipped for the conversational angle (type-writer). The IBM 360 computers made it possible to increase the size of the network

treated to 50 nodes and 200 branches but the conversational aspect was suppressed in the ECAP 360 version. With a view to making use of the possibilities of hybrid computers, the latter version was adapted to the EAI 8400 computer. Without diminishing it in any way it was modified so as to give it conversational characteristics by using the computer control panel; to give it still further flexibility it was given the facility to record curves during the calculation operation, and to obtain a division of the printed results. To obtain the curves, use was made of analog-to-digital converters at the interface of the hybrid unit EAI 8900 of which the EAI 8400 computer represents the numerical section. The modifications concern in particular the ac analysis and the transient analysis. They facilitate and complete the input of the data, they allow modifications to be made for the calculation of these analyses and they also improve the presentation of the results and facilitate their interpretation. They constitute the version ECASAC, i.e. the program ECAP 360 made conversational by use of a type-writer, with automatic output of the curves. Author (ESRO)

N69-33942# TRW Systems, Redondo Beach, Calif.
ONR STRUCTURAL COMPUTER PROGRAMS PROJECT (STORE) Final Report
Joseph Hrzina May 1969 31 p ref
(Contract N00014-68-C-0343)
(AD-687453; TRW-10050-6001-R0-00) Avail: CFSTI CSCL 9/2

The concept of a library of computer programs dealing with structural mechanics that can be readily accessed by all interested Navy agencies and field offices was investigated. This concept, identified as the Structures Oriented Exchange (STORE), would provide the maximum utilization of structural mechanics computer programs developed by and for the Navy. The objectives, requirements, and performance characteristics of the STORE computer program library system are discussed. Author (TAB)

N69-33962*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTER AIDED ANALYSIS AND DESIGN OF SPACE INSTRUMENT SYSTEMS
Robert M. Munoz *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 133–154 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 09B

The relationship between computer and space instrument system design for magnetometers is discussed with emphasis on advantages and disadvantages of systems and subsystems, and an example of the sensor electronics subsystem of the Ames magnetometer is given. A large number of digital computer programs for circuit analysis were mentioned and an example circuit analysis of a 6th order filter used in the magnetometer sensor electronics was presented. Computer use in the design development cycle by simulating the performance of the total integrated system was also discussed. A new method of approximating the transfer functions of subsystem components by generating a difference equation of the digital filter equivalent of the subsystem and integrating a number of difference equations thus found into a computer model of the total system functioning in the time domain provides answers for system performance that are too difficult to derive by conventional methods. Author

N69-33987# Stanford Linear Accelerator Center, Calif.
THE ON-LINE CONTROL, ANALYSIS, AND DISPLAY SYSTEM FOR THE SLAC MULTI-GeV/c SPECTROMETERS
A. Boyarski Mar. 1969 36 p Presented at the Conf. on Computer Systems in Exptl. Phys., Skytop, Pa., 3-6 Mar. 1969 Supported by AEC
(SLAC-PUB-659; CONF-690301-3) Avail: CFSTI

An on-line experimental system is described which consists of an SDS9300 with 32K core, an extensive set of peripherals, soft-ware including an assembler, a real time FORTRAN 4 compiler, a disk monitor, and a multiplexed interface system able to communicate with over 300 devices each having up to 24 bits of information. NSA

N69-33997# RAND Corp., Santa Monica, Calif.
RELATIONAL DATA FILE: EXPERIENCE WITH A SYSTEM FOR PROPOSITIONAL DATA STORAGE AND INFERENCE EXECUTION
Roger E. Levien Apr. 1969 37 p refs
(Contract F44620-67-C-0045)
(AD-687442; RM-5947-PR) Avail: CFSTI CSCL 9/2

An overview is given of the prototype Relational Data File, a computer data bank distinguished by the storage of data in a series of separate atoms of one binary relational sentence each, and the ability to retrieve data not explicitly stored that can be inferred from stored data. The prototype RDF contains 70,000 sentences extracted from scientific and technical source items. Each sentence is encoded in four 36-bit computer words, with synonyms automatically translated to standard form and ambiguities flagged for manual correction. New entries in the synonymy/ambiguity dictionary update all stored data. Each accepted sentence is quadruplicated and stored in four subfiles by each of the key elements. A string dictionary decodes entries for output. Special retrieval language, INFEREX, allows retrieval through any inference scheme that can be expressed in the predicate calculus and set theory. The RDF structure seems well suited for very large data bases where new types of data are continually being added and other types removed and where data are incomplete (as in rapidly changing fields), redundant, or unpredictable. Author (TAB)

N69-34009# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Plasma Physics Research Lab.
A COMPUTER PROGRAM TO READ AND EDIT FORTRAN PROGRAMS, OBJECT DECKS AND DATA Final Report
John P. Oss Jan. 1969 48 p
(AD-687855; ARL-69-0016) Avail: CFSTI

An automated system for manipulating source programs, object programs and data which is stored on magnetic tapes is discussed. The system has been used on an IBM 7044-7094 DCS system, but can be altered to work on other computers. Author (TAB)

N69-34090# California Univ., Los Angeles. School of Engineering and Applied Science.
LOGIC DESIGN AND INTERFACE OF A LINCOLN WAND SYSTEM
T. A. Makranczy Feb. 1969 130 p refs
(Contract AT(11-1)-gen-10)
(UCLA-10-P-14-71) Avail: CFSTI

A description of the design and interface of a 3-dimensional graphic input device is presented. The system functions as an auxiliary input device to a general purpose digital computer. The Lincoln Wand uses a sonic delay technique to periodically sample the position of a pen-sized stylus. The basic operating principles are presented and pertinent characteristics of the SDS Sigma 7 Computer and Graphics Station are described. A chapter is devoted to familiarizing programmers with the system's software and operational characteristics. The control logic is explained with logic diagrams, timing charts and logic equations. A data reduction algorithm and assembly language program are described. This program was timed using a software timing technique. The technique and results are furnished. Analysis of errors and resolution of the device are also treated. Author (NSA)

N69-34092# Stanford Univ., Calif. Dept. of Computer Science.
ASPECTS OF SPEECH RECOGNITION BY COMPUTER
Pierre Vicens (Ph.D. Thesis) Apr. 1969 228 p refs
(Contract ARPA SD-183; ARPA Order 457)
(AD-687720; CS-127; AI-M-85) Avail: CFSTI CSCL 17/2

The paper describes techniques and methodology which are useful in achieving close to real-time recognition of speech by a computer. To analyze connected speech utterances, any speech recognition system must perform the following processes: preprocessing, segmentation, segment classification, recognition of words, recognition of sentences. The paper presents implemented solutions to each of these problems which achieved accurate recognition in all the trial cases. Author (TAB)

N69-34146# Stanford Linear Accelerator Center, Calif. Linear Accelerator Center.
USE OF MAN-MACHINE INTERACTION IN DATA-FITTING PROBLEMS
Lyle B. Smith Mar. 1969 291 p refs
(Contract AT(04-3)-515)
(SLAC-96) Avail: CFSTI

The possibility of providing useful tools for numerically solving scientific problems in an on-line environment is explored. The development of such tools is then exemplified by interactive systems written for an IBM 2250 display console (CRT). Least squares data-fitting and related problem of numerical functional minimization is chosen as an example of a problem area which can benefit from on-line graphical interaction. Several other aspects of the design of interactive systems are discussed and exemplified by the design of PEG. PEG is related to other existing and proposed systems for on-line solution of mathematical problems. The PEG system includes orthogonal polynomials, Fourier approximations, spline functions (with fixed or variable joints), and user defined functions as fitting functions. The user defined function and spline functions with variable joints are non-linear problems whereas the other functions involve linear least squares problems. Fortran was used to do all the implementation except for a few 2250 routines coded in assembly language. Author (NSA)

N69-34174# Brookhaven National Lab., Upton, N.Y.
DATA ACQUISITION AND ANALYSIS COMPLEX FOR THE BNL LOW ENERGY ACCELERATOR FACILITY
P. C. Rogers 1969 11 p refs Presented at the Conf. on Computer Systems in Exptl. Nucl. Phys., Skytop, Pa. Sponsored by AEC
(BNL-13567; CONF-690301-5) Avail: CFSTI

The data acquisition and analysis complex is based on an SDS Sigma-7 computer with special purpose hardware. This complex will be time-shared by users at four independent accelerators. Each user may perform computations or data analysis while simultaneously collecting data and displaying results. A special feature of this complex is that the displays, programs, and data are maintained on disc memories thus freeing the central processor and core memory for independent time-sharing tasks. Author (NSA)

N69-34220# Signals Research and Development Establishment, Christchurch (England).
AUTOMATIC PLOTTING OF ROOT LOCUS DIAGRAMS
Margaret Fletcher Dec. 1968 21 p
(AD-687921; SRDE-68030) Avail: CFSTI CSCL 9/5

The Report describes a technique to examine the transfer function of an electrical network in which one parameter is variable. The locus of the poles and zeros of this function are plotted in the plane of the complex Laplace transform variable for discrete values of this parameter. This technique is valuable when examining the effects of tolerances on the performance of circuits and when deducing the inherent limitations of their response to a given input signal. The program is written in Algol for an Elliott 4130 computer. Author (TAB)

N69-34271# National Physical Lab., Teddington (England). Aerodynamics Div.
AUTOMATED PSYCHOPHYSICAL SIGNAL DETECTION EQUIPMENT
C. M. B. Anderson and S. D. G. Stephens (MRC Appl. Psychol. Res. Unit) Mar. 1969 15 p refs
(NPL-AERO-Ac-36) Copyright. Avail: CFSTI

The need for sophisticated methodology in psychophysical experiments is discussed with particular reference to the theory of signal detectability. Equipment is described which enables such experiments to be automated and applied in a programmed form using two-alternative forced-choice or yes-no procedures. Author (ESRO)

N69-34283# Argonne National Lab., Ill.
APPLIED MATHEMATICS DIVISION Summary Report, 1 Jul. 1967–30 Jun. 1968
30 Jun. 1968 96 p refs
(Contract W-31-109-eng-38)
(ANL-7521) Avail: CFSTI

Developments in computer systems and languages, numerical and mathematical research, computer utilization in divisional research, computer engineering, applied programming, digital computer operations, and the Argonne code center are reported. Also, publications and papers and seminars and symposia are listed. NSA

N69-34342# United Kingdom Atomic Energy Authority, Harwell (England).
COMPUTER SCIENCE RESEARCH, 1968
I. C. Pyle, R. G. Garside, R. C. F. McLatchie, T. D. Phillips, D. E. Rimmer et al Apr. 1969 26 p refs
(AERE-R-6075) Avail: CFSTI; HMSO 4s

A survey is presented in an attempt to present the "state of the art" in computer science research at the latter half of 1968. It draws largely on material presented at the IFIP Congress, 1968, but is not limited to that material. Hardware is not covered, nor all applications. Headings are as follows: Computer systems; operating systems; compiler techniques; data structures; file management; graphic displays; user interface; languages; facilities; atomatic documentation; selected applications; picture processing; information retrieval; computer assisted training; and simulation. NSA

N69-34346# California Univ., Los Angeles. Dept. of Engineering.
DEVELOPMENT OF A METACOMPILER CONTAINING LIST-PROCESSING CAPABILITIES
Robert Irving Gardner, Jr. Dec. 1968 117 p refs
(Contracts AT(11-1)-GEN-10; Nonr-233(52); ARPA SD-184)
(UCLA-10-P-14-65) Avail: CFSTI

A special list-processing system has been developed and integrated with a metacompiler. The special list-processing system is based on directed graph structures which can be created and manipulated by a programmer. Each directed graph structure is characterized by a set of nodes linked together by arcs. The combination of a list-processing facility and metacompiler has been found to be a useful laboratory tool for implementing special-purpose, high-level language translators and compilers and for implementing computer program optimizing systems. Author (NSA)

N69-34355# Stanford Linear Accelerator Center, Calif.
CONTROL AND MONITORING OF THE SLAC ACCELERATOR UTILIZING A PDP9 SYSTEM
Warren C. Struvan Apr. 1969 8 p refs Presented at the DECUS Symp., Wakefield, Mass. Sponsored by AEC
(SLAC-PUB-592; CONF-690510-1) Avail: CFSTI

A PDP9 system is being installed to supplement the manual controls and visual readout of the SLAC accelerator and to provide data logging for some 3000 points. Initially, malfunctioning klystrons will be sensed and suitable spares will be switched to multiple beams. Switching will be slow at first (up to 0.7 seconds) but a future parallel system will switch klystrons within one interpulse (2.7 ms). Summarized data will be read out weekly or bi-weekly from the disk. Later, magnetic tape will be used to transfer data from the disk to an IBM 360-91 for extensive off-line data reduction. Beam steering, focusing and spectrum control will be implemented. Author (NSA)

N69-34376*# Bellcomm, Inc., Washington, D.C.
THE BELLCOMM FORTRAN I/O PACKAGE
W. M. Keese 13 Feb. 1969 9 p
(Contract NASw-417)
(NASA-CR-104065; TM-69-1032-1) Avail: CFSTI CSCL 09B

On a computer as fast as the UNIVAC 1108, most programs are I/O input/output bound. That is, the computations performed on data can be done in less time than that required for reading the data and writing out the results, so the computation process must wait upon the I/O process. Bellcomm computer programs do their I/O through a set of library programs called the FORTRAN I/O Package. This has been rewritten in order to obtain greater speed through the use of buffering and item packing. Relative efficiency is a function of record sizes and their distribution in time, as well as storage medium. Two major production programs show speed increases of 66 and 400 percent respectively. The efficiency of the computer in execution of programs is roughly doubled, resulting in a 20 to 40 percent general throughput increase. Author

N69-34400# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
A HEURISTIC PROGRAM FOR SOLVING PROBLEMS STATED AS NONDETERMINISTIC PROCEDURES
Richard Earl Fikes (Ph.D. Thesis) Nov. 1968 271 p refs
(Contract F44620-67-C-0058)
(AD-688604; AFOSR-69-1400TR) Avail: CFSTI CSCL 9/2

The paper describes an effort to design a heuristic problem solving program in which the primary concerns are with the generality of the programs input language and the effectiveness and generality of the programs problem solving methods. To obtain the desired generality and ease of problem statement in an input language, extending a programming language is proposed to form a nondeterministic language which is suitable for stating problems. The extensions preserve the representational power and generality of the data and control structures of the base programming language. The scope and limitations of nondeterministic programming languages as input languages are discussed and compared with the input languages used by other problem solving programs. The program was designed to accept problems stated in a particular nondeterministic programming language and to deal effectively with the diversity of problems expressible in the language. The program translates a nondeterministic procedure into a heuristic search problem in which each object in the search space is itself a constraint satisfaction problem. The program combines heuristic search methods and constraint satisfaction methods to conduct the search and to solve the problems defined by the objects in the space. The behavior of the program on a set of example problems is described and analyzed. Author (TAB)

N69-34405# Royal Aircraft Establishment, Farnborough (England).
AN EQUIPMENT FOR INTEGRATION AND ANALYSIS OF SIGNALS IN NOISE
A. K. Edgar Aug. 1968 20 p refs
(RAE-TR-68223) Copyright. Avail: CFSTI

The development of a Fourier version of the Scampi generalized analyzer is described briefly. A feature of this system is the digital integrator using a recirculating ultrasonic line as the storage element. Applications of both the Fourier analyzer and the integrator are discussed. Author

N69-34407# Royal Aircraft Establishment, Farnborough (England).
AN INVESTIGATION INTO THE USE OF CYCLIC CODING FOR SPEECH BANDWIDTH COMPRESSION
J. P. Newsome (Nottingham Univ.) Jul. 1968 58 p refs
(RAE-TR-68194/UL) Copyright. Avail: CFSTI

A proposed approach to and method of speech bandwidth compression by the use of cyclic codes is examined. In particular, details are given of a study showing the effect of using different cyclic codes and different techniques for matching the digital cyclic code word to the digital speech signal. An extensive bibliography is presented for topics associated with this investigation. Author

N69-34449# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
THE DEVELOPMENT OF A SYSTEM OF DIGITIZED SPARK CHAMBERS IN COMBINATION WITH A COMPUTER [DIE ENTWICKLUNG EINES SYSTEMS VON DIGITALISIERTEN FUNKENKAMMERN IN VERBINDUNG MIT EINEM PROZESSRECHNER]
W. Schmidt-Parzefall Sep. 1968 80 p refs In GERMAN
(KFK-769) Avail: AEC Depository Libraries

Digitized spark chambers with ferrite core memory were developed. The detection and resolution characteristics of the spark chambers were measured and the use of a system of spark chambers and process computers in an e-d scattering experiment at DESY were described. Author (NSA)

N69-34458# Brookhaven National Lab., Upton, N.Y.
THE BROOKHAVEN ON-LINE DATA FACILITY
W. Love Mar. 1969 15 p refs Presented at the Conf. on Computer Systems in Experimental Nucl. Phys., Skytop, Pa., 3-6 Mar. 1969 Sponsored by AEC
(BNL-13478; CONF-690301-2)

After a brief review of the history of the BNL On-Line Data Facility a description is presented on the present configuration. (NSA)

N69-34505# California Univ., Berkeley. Lawrence Radiation Lab.
CHARACTERISTICS OF STANDARD FLOGIC CARDS
F. A. Kirsten 20 Feb. 1969 29 p refs
(UCID-3323) Avail: CFSTI

A system of nanosecond logic cards and hardware, called FLOGIC, has been recently developed for high-energy physics instrumentation. The FLOGIC cards which are considered to be standard are described. NSA

N69-34557# Army Tank-Automotive Center, Warren, Mich. Management and Data Systems Directorate.
SCHEDULING JOBS ON A COMPUTER: Cursory Review of the State-of-the-Art
Irwin F. Goodman May 1969 20 p
(AD-688048; S-1005) Avail: CFSTI CSCL 9/2

A cursory review of the state-of-the-art regarding the scheduling of jobs on computers is accomplished based upon a review of visits to ten computer facilities. During each visit the following type of information was gathered: How, operationally are the jobs scheduled on a day-to-day basis on the computer.; What sort of Mathematical logical theory is currently being used or contemplated for in the future for determining optimum sequencing of jobs on the computer.; What is the philosophy of management regarding the scheduling of jobs on the computer. Author (TAB)

N69-34589# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
COMPUTERIZED APPROACH TO BASIC WORK SAMPLING APPLICATIONS
P. L. Streit 31 Dec. 1968 37 p refs
(Contract AT(29-2)-656)
(GEPP-56) Avail: CFSTI

A system is described which eliminates manual calculation and applies accepted binomial probability approximations to work sampling data recorded in computer readable form. Separate data card designs permit the recording of 30 observations of work station oriented or mobile work groups in a single data card. Ten or eleven flexible categories of observations common to up to 6 sub-groups within a study are available. Any number of studies may be processed concurrently. File size is reduced to a maximum of 7 record cards per study after each run. User options ensure design freedom, progress and validity monitors, and termination of sampling at the earliest practical time. Sampler productivity gains of 25 to 50 percent are realistic depending upon the situation. Author (NSA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-33207# Air Force Cambridge Research Labs., Bedford, Mass.
APPLICATION OF PLASMA SIMULATION TO SLOT AND GAP ANTENNAS
Nicholas V. Karas and John D. Antonucci Apr. 1969 36 p refs *Its* Phys. Sci. Res. Papers No. 376
(AD-687333; AFCRL-69-0170) Avail: CFSTI CSCL 9/5

A plasma simulation technique has been applied to determine the effects of a plasma on the aperture admittance of radiators located on structures that are of a nonplanar shape. Specifically the normalized aperture admittance, with and without plasma, has been determined for a slot on cylinders of different radii, and for a cylindrical gap antenna. In addition, the plasma effects on the mutual coupling of two rectangular slots has also been found experimentally and compared to theory. All experimental results show good agreement with theory. Author (TAB)

N69-33208# Minnesota Univ., Minneapolis. Electron Tube Research Lab.
NOISE MEASUREMENTS AS A TOOL IN ELECTRON DEVICE RESEARCH Final Report, 1 Feb. 1966 – 31 Aug. 1968
A. Van Der Ziel Mar. 1969 189 p refs
(Contracts DA-28-043-AMC-01880(E); DA-36-039-AMC-00028(E))
(AD-687312; ECOM-01880-F) Avail: CFSTI CSCL 9/5

The sensitivity of a television camera system is limited by noise generated in the pick-up tube and in the amplifiers of the system. This work seeks and examines the effects of all the noise sources involved, and elaborated in particular on the noise sources of a Vidicon and of an SEC camera-tube. The overall system is given thorough theoretical attention; the two tubes mentioned have also been investigated experimentally. The results provide means and measures by which the sensitivity of a camera system can be rated; also, more significantly, by revealing the causes of noise they provide the understanding to be used to further improve the sensitivity of television cameras. Part B gives a survey of earlier work completed under the contract. It discusses secondary emission noise, noise in transmission secondary emission, in image intensifiers, in channel multipliers, and a survey of theorems on noise in television pick-up tubes. In all these cases full reference is made to earlier reports and (or) published papers. Author (TAB)

N69-33216# Electro-Optical Systems, Inc., Pasadena, Calif.
CHARGE-CONTROLLED STORAGE DISPLAY PANEL, QUARTERLY REPORTS, 1 MAY–31 OCT. 1968
Paul A. Foote Fort Monmouth, N. J. ECOM May 1969 47 p
(Contract DA-28-043-AMC-02482(E))
(AD-687308; EOS-7109-Q-8/9, ECOM-02482-8; QR-8/9) Avail: CFSTI CSCL 9/1

A number of the image panel's operating characteristics were investigated. A method for writing on the panel with the image of a cathode ray tube oscilloscope trace was tested. The panel's ability to store both very short, high-intensity images and very long, low-intensity images was also evaluated. Further investigations were made of the effects of humidity on the panel and methods to protect the panel from these effectr. It was shown that the contrast of images that are stored on a panel which is operated in room light can be enhanced by use of a circular polarizing filter in front of the panel. Permanent copies of stored images were made on a variety of photo-sensitive papers by a contact printing process. Improved techniques for fabricating photoconductively-charged image panels were developed. Fabrication of plastic substrate panels was continued, with emphasis on large-area (1 × 2 ft) panels. Author (TAB)

N69-33217# California Univ., Berkeley. Electronics Research Lab.
ELECTROMAGNETIC WAVE-CHARGE INTERACTION IN CROSSED FIELDS Quarterly Progress Report, 16 Nov. 1967–15 Feb. 1969
K. A. Fox, S. Swierkowski, T. Van Duzer, and K. Weller Fort Monmouth, N.J. ECOM Apr. 1969 31 p
(Contract DAAB07-67-C-0227)
AD-687314; ECOM-0227-7; QPR-7) Avail: CFSTI CSCL 9/1

The purpose of the work on this contract is to investigate the interaction of a electromagnetic waves and charge carriers in vacuum and solids. The construction of a crossed-field amplifier which will incorporate the results of the noise studies is in progress. Work on the crossed-field gun design method developed by R. A. Rao is being carried on to obtain designs for magnetically shielded guns. An experimental and theoretical evaluation of the crossed-field acoustic-wave amplifier is being conducted. Author (TAB)

N69-33219# Air Force Cambridge Research Labs., Bedford, Mass.
ASYNCHRONOUS EXCITATION AND THE ENTERTAINMENT AND PERIODIC PULLING EFFECTS FROM A SECOND INPUT
Edmond M. Dewan Apr. 1969 21 p refs *Its* Phys. Sci. Res. Papers No. 372
(AD-687332; AFCRL-69-0142) Avail: CFSTI CSCL 9/3

Asynchronous excitation (AE) by means of an asynchronous input that effectively modifies a hard oscillation so that it becomes soft, is investigated at the mathematical and physical levels. Computer simulation is used for displaying the phenomenon. It is also shown that a second input in the neighborhood of the oscillators natural frequency phase-locks the AE oscillation and causes periodic pulling just outside the detuning zone. Author (TAB)

N69-33242# Woods Hole Oceanographic Institution, Mass.
A CONTINUOUS CONFIGURATION HYDROPHONE ARRAY FOR BROADBAND CONTINUOUS SEISMIC PROFILING (PART 1) AND A COMPARISON BETWEEN THE RESPONSES OF A CONTINUOUS LINE ARRAY AND A DISCRETE LINEAR ARRAY (PART 2)
S. T. Knott and R. T. Nowak Apr. 1969 31 p refs
(Contract Nonr-4029(00))
(AD-687183; WHOI-REF-69-12) Avail: CFSTI CSCL 8/7

The signal-to-noise ratio of towed receivers employed in seismic reflection profiling is significantly improved by using a hydrophone array whose broadband directional response approaches that of a theoretically continuous sensor. Within a broad pass band all secondary lobes of an array of continuous configuration are less sensitive than the main lobe. This design improves upon the directivity and thus the signal-to-noise ratio realized in broadband work by those linear arrays in common use whose transducers are spaced widely compared to the wavelength and duration of transients of acoustical noise projected along the array from all angles of reception. Sensitivity equal to that of the main lobe is developed by the secondary lobes of these commonly used arrays at various frequencies and angles to the array. The 30-meter arrays of 200 equally-sensitive transducers described here have a broadband response approaching that of a continuous configuration. The average seismic signal received 1 second after the onset of the bottom reflections during a 0.5 second period is compared with the average noise received in the same passband for a similar period just prior to the bottom reflections. TAB

N69-33244# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE ANALYTICAL PROPERTIES OF TRANSISTOR BETA
Kosta A. Pullen, Jr. Mar. 1969 14 p refs
(AD-687265; BRL-MR-1965) Avail: CFSTI CSCL 9/1

The properties of current gain as used in the design of transistor circuits are analyzed in terms of parameter tolerances, physical limitations introduced by current differencing, and causes and handling of nonlinearity of current gain. It is shown that the dependence of current gain on a small difference of large numbers introduces difficulties which can only be minimized by smoothing techniques based on orthogonalization in a least-squares sense. The relation between d-c and small-signal current gains is established in terms of a Chebychev-type least-squares representation. Author (TAB)

N69-33272# Army Electronics Command, Fort Monmouth, N.J.
EFFECTS OF NEUTRON RADIATION ON SECOND BREAKDOWN AND THERMAL BEHAVIOR OF SILICON TRANSISTORS
Bernard Reich, Edward B. Hakim, and Edwin T. Hunter Mar. 1969 11 p refs
(AD-687259; ECOM-3098) Avail: CFSTI

A method of measuring and the subsequent analysis of this data has indicated that the thermal time constant of silicon diffused transistors decreases with increasing neutron dosage. Empirically, it was noted that thermal time constant degradation constants can be assigned to all devices examined. For the silicon planar devices studied, degradation constants varied from 2.6 × 10 to the −13th power sq cm/neut for the radiation resistant devices, to 1.4 × 10 to the −12th power sq cm/neut. For other devices examined. By examining previous data for single diffused transistors the thermal time constant degradation factor was 2 × 10 to the −11th power sq cm/neut. The conclusion of this report is that the thermal time constant, which is related to second breakdown, effectively degrades upon exposure to neutron radiation, thereby decreasing the safe operating area of the device. However, the extent of degradation per dose may be predictable by data presented in the text. Author (TAB)

N69-33286# Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, Md.
ON THE IMPROVEMENT OF ELECTRONIC EQUIPMENT RELIABILITY
Kosta A. Pullen, Jr. Apr. 1969 30 p
(AD-687290; AMSAA-TR-20) Avail: CFSTI CSCL 9/1

The reliability of certain airborne military electronic equipment in terms of measured mean time between failures (MTBF) has recently been shown to be between 3.5 and 6 hours. Reliability in this sense is usually based on actual measurement of time between failures rather than a statistical probability of failure occurring for a given period based on number of components. Improvement of reliability in this sense is based on a determination of the nature of the principal causes of failure and placement of them in the order of their descending probability of occurrence. Based on this ordering, one can often find ways of reducing the probability of occurrence of the causes of failure to the point where they can be considered to be random. Much of the control required for the high-probability causes of failure of electronics can be developed at the network design stage, since the electronic failure problem is frequently associated with either design difficulties or conditions of excessive heat in the environment. Particular emphasis is placed on data presentation herein, since experience has shown designers do work with inadequate information, a major part of the problem can be traced to inadequacies in characterization of components and devices, leading to excessive dissipation and excessive supply voltages. Further problems encountered as a consequence of the effect of a severe environment on a marginal design are discussed, and some ways of finding make-do fixes are described. Author (TAB)

N69-33310*# Weston Instruments, Inc., College Park, Md. EMR Div.
ELECTRONICALLY RESETTABLE FUSE
Roland E. Genter, inventor (to NASA) Filed 29 May 1969 18 p
(Contract NAS5-10229)
(NASA-Case-XGS-11177; US-Patent-Appl-SN-828921) Avail: CFSTI CSCL 09A

This fuse is suitable for protecting equipment in a spacecraft from power line surges. The components include a saturable core current sensing transformer having two outside legs and a center leg. An oscillator is connected to balanced oscillator windings around the outside legs so as to produce an ac flux which saturates the outside magnetic path at waveform peak points. A dc current whose magnitude is to be sensed is passed through a control winding around the center leg, producing a dc flux in the center leg which completes its loop through the two outside legs only during intervals when the outside path is unsaturated. This occurs twice per cycle and is sensed by another winding around the center leg. When the current in the control winding surpasses a bias level, the induced dc flux direction reverses and a 180° phase shift across the sense winding occurs. This phase reversal is sensed by a phase detector and utilized to open relay contacts connected to the control winding. External means for resetting the relay from a remote location are provided. NASA

N69-33428*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CAPACITOR AND METHOD OF MAKING SAME
Frank J. Hrach, inventor (to NASA) and Solomon S. Papell, inventor (to NASA) Filed 7 May 1969 9 p
(NASA-Case-10384-1; US-Patent-Appl-SN-822518) Avail: CFSTI CSCL 09E

A method is described for making a capacitor by solidifying a mixture of ferromagnetic particles, nonferromagnetic particles, and a dielectric material in the presence of mutually perpendicular magnetic and electric fields. The mixed particles are retained in a predetermined orientation by a dielectric matrix to form the capacitive body. Electrodes are provided on the body for electrical connections. NASA

N69-33434*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HELICAL RECORDER
Pleasant T. Cole, inventor (to NASA), Philip A. Studer, inventor (to NASA), and Allen L. Tyler, inventor (to NASA) Filed 7 May 1969 19 p
(NASA-Case-GSC-10614-1; US-Patent-Appl-SN-822534) Avail: CFSTI CSCL 09E

This tape recorder is intended for use as a spacecraft recorder, but it may also find application in areas where mass data storage requires high reliability in operation in extreme environments. The recorder uses a column of tape wrapped in a helix around a supporting drum rotated by a direct drive torquer. Tape separators and heads are mounted on a traversing system such that they are completely supported by the tape. The separators flex the tape at an angle sufficient to allow the heads to clear the tape stack. As the tape rotates, the archimedean screw effect causes the heads to track up and down the tape stack thus traversing the entire length of the tape. This recorder is expected to have more than double the life of state-of-the-art spacecraft recorders because it has a minimum of moving parts and employs a metal tape. NASA

N69-33462# Nucletron Gesellschaft fuer Nucleonic und Electronic m.b.H., Munich (West Germany).
OPERATIONAL PRINCIPLES AND PHYSICAL PROPERTIES OF SEMICONDUCTOR DETECTORS [WIRKUNGWEISE UND PHYSIKALISCHE EIGEN SCHAFTEN VON HALBLEITERDETEKTOREN]
R. Steudner *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 7–16 In GERMAN (See N69-33451 19-14)
Avail: CFSTI

The requirements placed on semiconductor detectors are outlined. The physical properties of germanium and silicon are summarized. The p-n transitions in semiconductors are described and the calculation of the density of the space-charge zone, field strength, rise time, and capacity is illustrated. Various detector types are described and examples are given of their application. NSA

N69-33464# Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Biologie.
ELECTRONIC PROCESSING OF PULSES FROM SEMICONDUCTOR DETECTORS [DIE ELEKTRONISCHE VERARBEITUNG VON IMPULSEN AUS HALBLEITER-DETEKTOREN]
F. W. Stanek *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 36–55 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

Beginning with a radiation-induced pulse in a semiconductor detector, the theory of the charge-sensitive preamplifier (charge–voltage converter) was treated, in which the effects of the transient statistical pulse sequence, the nonlinearity of the amplifier, and the noise on the spectral resolution capability was introduced. The further processing of the pulse, possible deterioration of the spectral resolution, and measurement errors caused by the following electronics were also considered. Author (NSA)

N69-33455# Technische Hochschule Munchen (West Germany). Institut fuer Elektronik.
THEORETICAL LIMITS OF THE ENERGY RESOLUTION OF SOLID-STATE IONIZATION CHAMBERS, USING Ge(Li) DETECTORS AS AN EXAMPLE [DIE THEORETISCHE GRENZE DER ENERGIEAUFLOESUNG VON FESTKOERPERIOMISATIONSKAMMERN AM BEISPIEL DES Ge(Li)-DETEKTORS]
P. Eichinger *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 57–81 In GERMAN (See N69-33451 19-14)
Avail: CFSTI

Various models describing electron-hole pair formation in semiconductor detectors by charged particles and gamma radiation are discussed. Factors which limit the resolution of semiconductor detectors such as pulse rise-time and background and the Fano factor are described. For a lithium-drifted germanium detector with a Fano factor ≤ 0.2 the attainable energy resolution at half maximum intensity is 1.8 keV for 1 MeV particles (≈ 0.2 percent) and 5 keV for 10 MeV particles (≈ 0.05 percent). NSA

N69-33466# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernphysik.
EXPERIENCES WITH A COOLED FET PREAMPLIFIER WITH EXTREMELY LOW NOISE [ERFAHRUNGEN MIT EINEM GEKUEHLTEN FET-VORVERSTAERKER MIT EXTREM NIEDRIGEM RAUSCHEN]
U. Tamm *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 62–67 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

The circuit of a FET preamplifier is given and described. Its noise contribution was experimentally determined and the results were compared with those calculated. The optimum time constants can be determined from the individual noise constituents. The preliminary experiments made with this preamplifier are briefly outlined. NSA

N69-33475*# Westinghouse Electric Corp., Youngwood, Pa. Semiconductor Div.
DESIGN AND DEVELOPMENT OF A HIGH POWER, LOW SATURATION VOLTAGE MULTI-CHIP SILICON SWITCHING TRANSISTOR Final Progress Report
Ernest R. Stonebraker May 1969 28 p Prepared for JPL
(Contracts NAS7-100; JPL-952309)
(NASA-CR-103843) Avail: CFSTI CSCL 09A

This report describes the work done to design and develop a multi-chip transistor. The requirements include a very low saturation voltage, namely, $V_{CE(sat)} \leq 0.1$ V at 75 A collector current with a base current of 5 A. The principle efforts were on mechanical design and matching of chips. Author

N69-33488*# Singer-General Precision, Inc., Glendale, Calif. Librascope.
STUDY OF FAILURE AND RELIABILITY OF MICROELECTRONIC DEVICES Quarterly Report, 1 Oct.–31 Dec. 1968
14 Feb. 1969 11 p
(Contract NAS12-72)
(NASA-CR-86194; Rept-2-0512; QR-13) Avail: CFSTI CSCL 09A

Without predicting the source or composition of the surface anomalies, or their possible effects, each defect, without losing identification, was subjected to environmental extremes and structural examinations. The intent is to accelerate any deleterious effects, especially those statistically identifiable with a surface defect category. Device performance is monitored by verifying selected dc parameters following each environmental stress. The parameter measurement data has not thus far been statistically reduced but visual examination has revealed no catastrophic failures (open or shorted circuits). Two hundred fifty hours of the life test and measurement Point 11 have been completed. Author

N69-33492*# General Electric Co., Philadelphia, Pa.
ROLLUP SUBSOLAR ARRAY Quarterly Technical Report, 5 Mar.–30 May 1969
K. L. Hanson, ed., F. Blake, N. Luria, R. Kyle, R. Ferguson et al
12 Jun. 1969 74 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952314)
(NASA-CR-103842; DOC-69SD428; QTR-1) Avail: CFSTI CSCL 09E

The design and development of a 30-watt per pound rollup solar array is reported. The analysis of the effects of the stowed vibration, of the dynamic loads used in the feasibility design, bearing and lubrication selection, electrical performance, results of thermal cycling of segments of the array blanket, and work to date on analytical modeling of the system in the stowed and deployed configuration are included. The system design concept is described. Author

N69-33497*# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
THERMIONIC CATHODE EVALUATION STUDY Interim Report, 1 Jan.–31 Mar. 1969
F. T. Hill 23 May 1969 20 p Prepared for JPL
(Contracts NAS7-100; JPL-951810)
(NASA-CR-103848; PT-2249; IR-7) Avail: CFSTI CSCL 09A

Diodes using pore-dispenser cathodes have completed at least 12781 hours of satisfactory life burning at cathode temperatures of 950°C to 1100°C and at current densities of 0.2 A/cm^2 to 1.6 A/cm^2. Diodes using standard oxide cathodes have completed life burning cycles varying from 9638 to 11958 hours. The diodes are showing cathode emission slump at current densities above 0.15 A/cm^2 and cathode temperature of 825 and 850°C. Six lots of diodes (24 total) were constructed and exhausted with three different cathode nickel alloys with oxide and coated-particle coating. The cathode coating peeling problem was eliminated in these diodes by the addition of a powdered nickel layer between the cathode face and the coating layer. Author

N69-33570# Academia R. P. R., Bucharest. Institutul de Matematica.
RELAY CONTACT CIRCUITS [CIRCUITE U CONTACTE DE RELEE]
Leon Livovschi 1968 251 p refs In RUMANIAN; ENGLISH summary
Avail: CFSTI

A synthesis method is presented for dipoles and multipoles with contacts. The dipoles and multipoles were discussed with and without repetition, and negative and non-negative variables, also with arbitrary functions. Dipoles are cited which have rectifiers and lock composition. Boolean equations are given for these functions. E.H.W.

N69-33725# Institute of Technology, Helsinki (Finland). Radio Lab.
ELECTRONICALLY TRACKING ANTENNA SYSTEM FOR SATELLITE RECEPTION
Kalevi Kalliomaeki and Martti Tiuri 1968 14 p refs
(S-25) Avail: CFSTI

Receiver antennas for satellite reception in the HF and VHF range usually use mechanical tracking. For several reasons, however, an electronically tracking antenna is preferable at fully automatic stations. An electronically tracking antenna system, called a hedgehog antenna is described. The hedgehog antenna consists of several, differently directed antennas to cover the whole sky. An electronic switch, controlled by the satellite receiver, connects the receiver to the antenna from which the desired satellite signal is obtained. Author

N69-33749# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
BACKFIRE ANTENNAS Progress Report, 1 Jul. 1967–31 Dec. 1968
E. Drago Nielsen and K. Pontoppidan Jan. 1969 46 p refs
(Contract F61052O-67-C-0056)
(AD-687744; R-69; AFCRL-69-0109; PR-8) Avail: CFSTI CSCL 9/5

A method for a theoretical investigation of arbitrary backfire antennas based upon the Yagi antenna structure was set up. The mutual impedances between the dipole elements of the antenna has been taken into account, and the field radiated due to a surface wave reflector of finite extent has been calculated using the method of physical optics. Numerical results obtained for Yagi backfire antennas, short-backfire antennas, and Yagi antennas using this theory were compared with numerical and experimental results obtained by others and with experimental results obtained in the Radio Anechoic Chamber of the Technical University of Denmark. Author (TAB)

N69-33756# California Univ., Berkeley. Lawrence Radiation Lab.
APPLICATION OF THE TWO-POWER-SUPPLY METHOD TO THE FERRITE BIAS OF AN RF RESONATOR OF A RAPID-CYCLING SYNCHROTRON
Louis L. Reginato and Bob H. Smith 3 Feb. 1969 7 p
(Contract W-7405-ENG-48)
(UCRL-18489) Avail: CFSTI

The ferrite bias equipment for the rf resonators of high-repetition-rate synchrotrons is expensive. This is a result of the high voltage necessary to overcome the back emf of the unsaturated ferrite at the beginning of the sweep, and the high current necessary to saturate the ferrite at the end of the sweep. The high frequency resonators of the Omnitron, which sweep in 8 ms, require 70 V initially, but only 20 V after the first 2 ms, when the current reaches 5 kA. The voltage remains low for the remainder of the sweep, while the current increases to 20 kA. To meet these requirements as inexpensively as possible, a pulse-type power supply is used during the first 2 ms, and a high-current power supply through the remainder of the sweep. Smooth current transfer is an inherent property of the circuit. Inductance, which is surprisingly costly, is kept to a minimum by a 'sandwich' bus bar technique. A silicon-controlled-rectifier (SCR) switch reverses the current every other sweep so that the full hysteresis loop of the ferrite is used. A regulator circuit forces the bias current to follow a reference pulse. Author (NSA)

N69-33838# Signals Research and Development Establishment, Christchurch (England).
AUTOMATIC FORMATION OF TRIAL LAYOUTS OF THIN-FILM MICROCIRCUITS
W. J. Cullyer, Sylvia Tubbs, A. P. Stockton, and A. R. Guscott Oct. 1968 47 p refs
(AD-687920; Rept-68027) Avail: CFSTI CSCL 9/5

Details are given of the principles of a computer program which forms trial geometrical layouts of thin-film microcircuits. The designer specifies the network after having rearranged the circuit diagram to a suitable form in which the positions of the crossovers are defined. The program does not solve the fundamental topological problems which arise in arranging the layout. Given the parameters of the specific technology and the redrawn circuit diagram as data, the program forms a trial layout which is unconstrained in size. Brief comments are included about the current development of a second program which condenses this trial layout. These programs belong to a set which should enable thin-film microcircuits to be laid out with a minimum of human intervention. Author (TAB)

N69-33960*# Marquette Univ., Milwaukee, Wis. Dept. of Electrical Engineering.
DESIGN AND PERFORMANCE OF A MICROWAVE MOTOR
Jan K. Sedivy *In its* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 103–117 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 09A

This paper describes a microwave motor, its characteristics and properties obtained experimentally in addition to the analytical derivation of induced voltage, current and produced torque. Motors with a power input of approximately 2 Watts operating at a frequency in the neighborhood of 3300 Mc have been built and tested experimentally. The lower limit of operating speed was 20 RPM, the upper limit approximately 1200 RPM. The motor has the advantage of simple construction, contains no commutator; when used in a wave guide reversal of direction of rotation is easily accomplished. Since the microwave energy can be transmitted over large distances the microwave motor may find use and application in control and actuation of space vehicles or components for space program. Author

N69-34001*# Teledyne Industries, Inc., Pasadena, Calif. Earth Sciences Div.
QUADRUPOLE MASS SPECTROMETER Final Report
W. M. Brubaker Jul. 1969 63 p refs
(Contract NASw-1736)
(NASA-CR-104070; ES-4103) Avail: CFSTI CSCL 09E

Theoretical and experimental studies are made of the operation of a quadrupole mass spectrometer in the presence of a high background pressure of hydrogen. The mass filter was found to be amazingly tolerant of the high pressure. When ions from a thermal source are introduced, the resolving power remains unaltered at pressures of 10^{-2} torr. Transmission efficiency of these thermal ions starts to decrease at a pressure of 10^{-3} and is down to about 20 percent at 10^{-2}. When an electron bombardment ion source is used, the space charge of the positive ions degrades the resolving power attained at a given transmission efficiency at pressures above 10^{-5} torr. Comparisons of wide mass range spectra made in the conventional and in the delayed dc ramp modes illustrate the predicted discrimination against ions of high mass. The discrimination results from the longer time required for ions of heavy mass to traverse the entrance fringe fields where the y-trajectory is highly unstable. Author

N69-34011# Innsbruck Univ. (Austria).
ON THE PROPAGATION OF VLF WAVES IN SOLIDS AND LIQUIDS Final Report, 1966–1968
W. Bitterlich, W. Gradl, Chr. Grissemann, W. Kellner, and R. Lukavec Dec. 1968 128 p refs
(Contract AF 61(052)-902)
(AD-687751; AFCRL-69-0152) Avail: CFSTI CSCL 9/5

Impedance, current distribution and radiation characteristics were measured on various types of antennas in air and in water in continuation of examinations on small self-resonant helical antennas. Two methods of determining the conductivity and dielectric constant of a dissipative medium with graphical evaluation are described as an example of applying measurements of frame antenna directivity patterns. Radio communication was reached between the mine of Schwaz and the mine of St. Gertraudi by means of a 1600 sqm frame antenna and a new low-noise receiving amplifier. Preliminary examinations were made for geoelectric ore examinations, and a measuring probe was built for drill hole examinations. Author (TAB)

N69-34061# Syracuse Univ., N.Y. Dept. of Electrical Engineering.
APPLICATION OF MATRIX METHODS TO ARRAY ANTENNA PROBLEMS
Bradley J. Strait and Kazuhiro Hirasawa Apr. 1969 48 p refs
(Contract F19628-68-C-0180)
(AD-687481; AFCRL-69-0158; SR-2) Avail: CFSTI CSCL 20/14

Matrix methods are applied for solutions of a variety of problems involving arrays of wire antennas. The versatility of matrix methods for this application is emphasized. It is shown that once the array geometry and the positions of the feed points are known both scattering and radiation problems can be handled by appropriate matrix manipulations. Problems in both array design and analysis are discussed along with examples involving beamwidth and sidelobe reduction, gain maximization, and use of parasitic elements and parallel conducting ground planes. It is pointed out how attention can be changed easily from one problem to another through very simple changes in program instructions or data input. Author (TAB)

N69-34112# Atomic Weapons Research Establishment, Aldermaston (England).
MATERIALS PROBLEMS IN MICROELECTRONIC CIRCUITS
R. G. Loasby 1969 9 p Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 9–11 Apr. 1969
Avail: CFSTI

The production of multilayered microelectronic circuits using thick films, requires materials compatibility to be maintained through several firing stages along with flat printing surfaces. It is also necessary to have an insulating material which will not flow, interact with, or degrade, the metallisation on repeated firing cycles. The material should also have specific electrical properties, one of which, for interconnection circuits, would be low dielectric constant values. All requirements can be met by an insulant paste formed by loading a suitable glass with a ceramic powder. The paste has such a high viscosity at its firing temperature that interaction is localised to the bounding surfaces. No mass movement and no degradation takes place and details of the use of such materials in multilayering processes are given. This technology has also been combined with thin film methods in order to achieve higher yields in dense circuits, particularly in crossover regions, and to provide a facility for the face down bonding of integrated circuits. ESRO

N69-34117# Radio Corp. of America, Somerville, N.J. Defense Microelectronics.
SOLID STATE NONVOLATILE MEMORY Final Report
A. K. Rapp, U. Bharali, and J. M. Mitchell Washington HDL May 1968 73 p refs
(Contract DAAG39-67-C-0084)
(AD-687356) Avail: CFSTI CSCL 9/5

Means were studied for achieving an electrically settable, unpowered memory for integrated circuit counters via a matrix of fusible conductors. The concept stores desired codes by burning out appropriate fuses in a selected row of the fuse matrix. Provision also is made for changing the stored code by burning out appropriate fuses in a new row and recording the location of the operative row via supplementary fusible conductors. To permit fabrication of fuses as part of MOS integrated circuit arrays, compatible fabrication techniques were investigated. Experiments were conducted with four different metals: aluminum, nickel, nichrome, and tin. It did not prove possible, however, to make fuses with sufficiently low fusing-power levels to permit burnout control via integrated MOS transistors; separate fuse drivers are required. A successful fuze-timer system based on a fusible-conductor memory was developed. Operation of a portion of the system was demonstrated using a breadboard model. Author (TAB)

N69-34119# Army Foreign Science and Technology Center, Washington, D.C.

A RELAY-PULSE REGULATOR

A. S. Popov Apr. 1969 9 p Transl. into ENGLISH of Russian Patent no. 196157 (5 Nov. 1965) 9 p

(AD-687819; FSTC-HT-23-277-68-A) Avail: CFSTI CSCL 9/5

The invention describes an improved transistorized relay-pulse control circuit for the automatic regulation of certain conditions, e.g., temperature or pressure. Relay hysteresis is overcome by employing a multivibrator as an electronic switch which insures that cycling of the device occurs at an established level of the regulated value. Author (TAB)

N69-34130# Danish Research Centre for Applied Electronics, Copenhagen (Denmark).

TANTALUM CAPACITORS OF THE DROP TYPE: INVESTIGATION OF SIX MANUFACTURERS [TANTALKONDENSATORER AF DRABETYPE: KVALITETSSAMMENLIGNENDE UNDERSOEGELSE AF SEKS FABRIKATER]

S. T. Olesen Apr. 1969 60 p In DANISH; ENGLISH summary Sponsored by Sammenslutningen for Palideligheds- og Miljoetek.

(ECR-06) Avail: CFSTI

The investigation includes dry tantalum capacitors of the 'drop' type, 6 different manufactures with totally about 360 capacitors have been examined. Load life tests with and without voltage, damp heat tests, terminal strength tests, and impedance measurements during various temperature-, frequency-, and voltage-conditions have been carried out. The investigation has shown that the capacitors are fairly stable as to degradation failures whereas some catastrophic failures occurred. However, a few of the manufactures were quite faultless. Author (ESRO)

N69-34142# Naval Avionics Facility, Indianapolis, Ind.

NON-CONTACT POTENTIOMETER STUDY Interim Report

Daryle E. Riegle Apr. 1969 85 p refs

(AD-687419; NAFI-TR-1364) Avail: CFSTI CSCL 9/1

This report discusses non-contacting shaft position sensors with emphasis on the optical technique. A theoretical study of the photoconductor characteristics and its effect upon the potentiometer is made for four possible optical configurations. A detailed examination of end effects is included; however, no consideration is given to the mechanization of these different approaches. The results of an industry survey are enclosed. Author (TAB)

N69-34153# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE THERMAL NOISE OF CASCADED MISMATCHED PASSIVE TWO-PORTS IN THE MICROWAVE RANGE [DAS THERMISCHE RAUSCHEN VON SERIENGESCHALTETEN, FEHLANGEPASSTEN PASSIVEN VIERPOLEN IM MIKROWELLENBEREICH]

Gernot Kraus Jan. 1969 10 p refs Transl. into ENGLISH from Arch. Elek. Übertragung, v. 23, Ser. 1, Jan. 1969

(Contract NAS7-100)

(NASA-CR-103885) Avail: CFSTI CSCL 09E

The thermal noise of certain transmitting two-ports was considered in addition to the effects of mismatching and loss in the system. A comprehensive relation for the output transmission by mismatched passive two-ports with their own noise-output contribution is described by matrix methods. A general equation is derived for the total reflectivity-dependent output available at the receiver input. Reflectivity factors, coefficients, and scattering matrices are calculated for cascaded two-ports by recursion formulas from known equations. As a consequence, improved calibration methods can be recommended for matched and mismatched networks. M.H.E.

N69-34249# Central Lab. for Radiological Protection, Warsaw (Poland).

A SIMPLE MOSFET CHARGE-TO-PULSE CONVERTER FOR THERMOLUMINESCENCE READER [PROSTY UKLAD KONWEETERA LADUNKU ELEKTRYCZNEGO Z ZASTOSOWANIEM TRANZYSTORA TYPU MOSFET PRZEZNACZONY DO CZYTNIKA TERMOLUMINESCENCYNEGO]

St. Glowacki 1968 7 p ref

(CLOR-69-D) Avail: AEC Depository Libraries

A simple charge-to-pulse converter circuit is described. The converter is simple, reliable and transforms proportionally charge-to-pulses for the current in the range from 5×10^{-10} to 5×10^{-4} A. The circuit has been designed especially for the application in a thermoluminescence reader. Author (NSA)

N69-34276# Army Foreign Science and Technology Center, Washington, D.C.

CERAMIC HIGH VOLTAGE CAPACITORS K-15U-1, K-15U-2, and K-15U-3

N. V. Stavitskaya et al, ed. May 1969 57 p Transl. into ENGLISH of Russian State Standard GOST 7160-67, 1967

(AD-687317; FSTC-HT-23-762-68) Avail: CFSTI CSCL 9/1

The standard applies to capacitors of fixed capacitance having a ceramic dielectric, designed for operation in direct current circuits with a voltage up to 30 kv, in high-frequency alternating current circuits with a voltage up to 25 kv sub eff and in pulse modes. Author (TAB)

N69-34312# Iowa State Univ. of Science and Technology, Ames.

PREPARATION OF PLANAR LITHIUM-DRIFTED GERMANIUM DETECTORS

Glen L. Jackson (M.S. Thesis) Feb. 1969 62 p refs

(Contract W-7405-ENG-82)

(IS-T-296) Avail: CFSTI

Lithium has been drifted into germanium using both boiling-liquid and plate-type drift apparatus. Both methods have been investigated at two temperatures, the 320.8 °K boiling temperature of Freon 113 and the 297 °K boiling temperature of Freon 11. It was found that the lithium drift rate was closer to the theoretical value at the higher temperature than it was at the lower temperature. The drift rate should be closer to the theoretical value at the higher temperature because the solubility of lithium in germanium rises with temperature. In one plate-type drifter the temperature and drift voltage were maintained constant, but the drift current varied. In the other plate-type drifter the drift voltage and

drift current were maintained constant, but the temperature varied. Both plate-type drifters allowed lithium to be drifted into germanium to a depth of 5 mm, but the leakage current of 20 mA for the constant-voltage, constant-current process was much less than the leakage current for the constant-temperature, constant-voltage process. Author (NSA)

N69-34336# Air Force Cambridge Research Labs., Bedford, Mass.
ON THE PROBLEM OF EQUAL-RIPPLE POWER PATTERN SYNTHESIS Interim Scientific Report
Hans Steyskal Jan. 1969 45 p refs Supported by Swed.-Am. Found., Stockholm *Its* Phys. Sci. Res. Papers No. 386
(AD-687747; AFCRL-69-0015) Avail: CFSTI CSCL 9/5

The report on antenna array pattern synthesis deals with the approximation of power patterns rather than the usual problem of approximating field patterns. After a qualitative comparison of the different characteristics an optimum approximation is formulated in general terms. The possibility of finding an exact equal ripple solution is discussed, and an approximate equal ripple solution is offered as an approach to this as yet unsolved mathematical problem. Author (TAB)

N69-34340# Atomic Weapons Research Establishment, Aldermaston (England).
COMPARISON OF THE SHORT PERIOD SEISMIC NOISE AT THE FOUR UKAEC TYPE ARRAYS AND AN ESTIMATE OF THEIR DETECTION CAPABILITIES
R. F. Burch Jan. 1969 18 p
(AWRE-O-79/68) Avail: CFSTI; HMSO 3s

Samples of short period noise from arrays at Eskdalemuir (Scotland), Yellowknife (Canada), Gauribidanur (India) and Warramunga (Australia) were analyzed by analog methods for both frequency content and amplitude. This analysis was carried out for outputs of both a single seismometer and for the sum of the outputs for all the seismometers in the array. The power of the arrays to increase the signal-to-noise ratio was calculated, and detection thresholds were estimated for the four arrays based on the array processing techniques of delay and sum. Author (NSA)

N69-34341# California Univ., Livermore. Lawrence Radiation Lab.
OVERVIEW OF COMPUTER-AIDED CIRCUIT DESIGN
Franklin F. Kuo and Waldo G. Magnuson, Jr. 30 Apr. 1969 7 p refs Presented at the Symp. on Inform. Process., Lafayette, Ind.
(UCRL-71678; CONF-690410-1) Avail: CFSTI

A review of the development of computer-aided circuit design, mainly integrated circuits, is presented. Progress toward achieving large-scale integration whereby hundreds of gates can be fabricated on a single chip is summarized. Also, the use of graphic consoles for computer input and output is discussed. NSA

N69-34367# Army Electronics Command, Fort Monmouth, N.J.
NEW HIGH-POWER ELECTRONIC TUNING CAPABILITIES BY EXPLOITATION OF TENSOR RELATIONSHIP OF ABSORPTION AND DISPERSION IN FERRITES
Emanuel Gikow Apr. 1969 23 p refs
(AD-688511; ECOM-3113) Avail: CFSTI CSCL 9/5

A technique is described for high speed electronic tuning of an inductive device capable of handling VHF powers in excess of 100 watts CW. Electronic tuning is accomplished by means of a controlled dc bias applied to an inductor with a ferrite core. As opposed to conventional magnetic bias tuning the ferrite core is operated above saturation. In this mode it is seen the ferrite cores can be operated with high r.f. fields with no detectable degradation of Q and negligible distortion products. Specific examples are presented of the application of this new capability in medium power amplifiers operating over the frequency range of 70 to 300 MHz. Author (TAB)

N69-34377*# Westinghouse Electric Corp., Huntsville, Ala.
DEVELOPMENT OF MULTILAYER EPITAXY FOR HIGH RELIABILITY TRANSISTORS Interim Summary Report, Apr.–Dec. 1968
Dec. 1968 29 p refs
(Contract NAS8-18125)
(NASA-CR-98037) Avail: CFSTI CSCL 09E

The design and process technology developed to yield high reliability, high current transistors is described. These 100 ampere PNP transistors have epitaxially grown base and collector regions, diffused emitter regions, and feature compression bonded encapsulation. Transistors with several different collector resistivities and base widths were investigated to determine the relationship between high current gain, saturation and sustaining voltages. In order to improve the gain and saturation performance for a given sustaining voltage, methods of increasing bulk lifetime were evaluated. Author

N69-34380*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
BIOMEDICAL DATA GROUND LEAD SYSTEM Final Report
A. L. Weitzmann 31 Jul. 1969 31 p ref
(Contract NAS9-9357)
(NASA-CR-101806; LMSC/687932) Avail: CFSTI CSCL 09E

A biomedical ground lead system was designed and tested to prevent dangerous values of electric current from flowing through an astronaut's ground electrode, while providing a low resistance path to ground for draining static charges, and providing electrical ground reference for bioinstrumentation. The engineering prototype system consists of a circuit containing two high voltage field effect transistors (FETs), two pinch-off current FETs, and one resistor. Destructive and other tests results are given. Safety analysis shows a predicted reliability of 99.7%. J.M.C

N69-34433# Stanford Linear Accelerator Center, Calif.
TECHNOLOGY OF BUILDING LARGE-SIZE SPARK CHAMBERS AND HIGH CURRENT PULSE GENERATORS FOR THEIR SUPPLY
K. A. Baicher et al [1969] 19 p ref Transl. into ENGLISH of Russian report JINR-P13-4191
(SLAC-Trans-94; JINR-P13-4191) Avail: CFSTI

The design of large spark chambers and the associated pumping and filling are described. A new solution has also been found for making reliable high-voltage high-current pulse generators capable of supplying such chambers. Author (NSA)

N69-34436# Stanford Linear Accelerator Center, Calif.
HIGH-SPEED SWITCHING PROPERTIES OF THE EMITTER-COUPLED TRANSISTOR-PAIR
Arpad Barna Mar. 1969 44 p
(Contract AT(04-3)-515)
(SLAC-97) Avail: CFSTI

High-speed switching properties of the emitter-coupled transistor-pair are analyzed by means of a digital computer. Waveforms and risetimes are computed for a wide range of parameters. The resulting risetimes are interpreted in terms of the gain-bandwidth products of the transistors, external capacitances, and the risetime of the input signal. Author (NSA)

N69-34467# Radio Corp. of America, Lancaster, Pa.
ADVANCED HEAT PIPE THERMIONIC TECHNOLOGY. TASK 1. DEVELOPMENT OF HIGH VOLTAGE MODULE Midterm Status Report, 1 May 1968–28 Feb. 1969
R. W. Longsderff 28 Feb. 1969 51 p
(Contract AT(30-1)-3979)
(NYO-3979-1) Avail: CFSTI

The design of a heat pipe-thermionic module concept capable of output potentials as high as 28 volts was investigated. Technologies required for this module design were developed beyond the state-of-the-art. An advanced Al_2O_3 casting technique was developed for the fabrication of the key insulated tri-layer assembly. Arc suppression coatings were developed for the prevention of voltage arcs in the module due to potentials above the ionization potential of cesium. Fabrication and assembly techniques necessary for the logical development of the high voltage module concept were also investigated. Heat pipe designs capable of transferring the required thermal through-put for high voltage module concepts were also investigated. Author (NSA)

N69-34470# California Univ., Berkeley. Lawrence Radiation Lab.
APPLICATION OF TELEPHONE CROSSBAR RELAYS TO COMPUTER CONTROL OF A PARTICLE ACCELERATOR
James W. Davis, Warren L. Dexter, and Bob H. Smith 31 Jan. 1969 25 p refs
(Contract W-7405-ENG-48)
(UCRL-18493) Avail: CFSTI

A prototype automatic control system using crossbar relays for switching was built for experimental study. Eleven sets of these highly reliable and inexpensive relays can provide computer or manual access to the control of 1000 magnets or other regulated systems. The system consists of a computer, several manual-control panels, a set of crossbar relays, digital regulator references and actuating devices, and a corresponding readback system. The manual-control panels contain an address keyboard, which controls the crossbars, and a data-entry keyboard. The data are routed to the desired regulator reference or actuator. For automatic operation the computer simply replaces one of the manual-control panels. The coil-to-contact isolation in the regulator reference chassis and digital readout systems provide essentially infinite noise isolation between the accelerator and the control system. Design considerations of the special devices which are unique to this type of control are included. Author (NSA)

N69-34548*# Ling-Temco-Vought, Inc., Anaheim, Calif. Research Center.
MOMENTUM SENSOR: ELECTROSTATIC BALLISTIC PENDULUM LABORATORY CALIBRATION UNIT Final Report
Frank E. Jasmine Jul. 1969 35 p
(Contract NAS9-8870; LTVR Proj. 08550)
(NASA-CR-101803) Avail: CFSTI CSCL 09E

An electrostatic ballistic pendulum impact momentum transducer has been designed for producing an electrical signal proportional to the momentum of an impacting particle. A unique sensing method assures useful measurement over eight orders of magnitude in momentum. The transducer consists of a rigid plate supported resiliently from a central portion and a conductive backplate. A conductive portion of the plate is adjacent but electrically isolated from the backplate such that capacitance is formed in between. Particles impinging upon the plate cause a displacement of the plate toward the backplate in such a manner that a detectable variation of the capacitance between the backplate and the conductive portion occurs. The variation is proportional to the momentum of the particle regardless of its point of impingement. Author

N69-34594# Radio Corp. of America, Lancaster, Pa.
ADVANCED HEAT PIPE THERMIONIC TECHNOLOGY. DEVELOPMENT OF ADSORPTION RESERVOIR Topical Report, 1 May 1968–28 Feb. 1969
R. A. Freggens 28 Feb. 1969 44 p refs
(Contract AT(30-1)-3979)
(NYO-3979-2) Avail: CFSTI

Work performed on the development of an integral adsorption reservoir thermionic converter is described. Three general areas were investigated. These were: cesium purification, material processing, and integral reservoir converter fabrication. The cesium purification employed a high temperature reaction to remove halide compounds from the cesium. The development of a large surface to volume ratio in a molybdenum matrix was studied. Variations in time, temperature, and atmosphere for sintering the matrix were used as the basis of the study. The RCA A-1279 Thermionic Converter was selected as a suitable test vehicle for reservoir evaluation. The design was modified to allow 78 cm^3 of reservoir matrix to be integrally located within the converter. Author (NSA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-33228# Bose Corp., Natick, Mass.
RESEARCH INVESTIGATIONS ON FEEDBACK TECHNIQUES AND METHODS FOR AUTOMATIC CONTROL Final Technical Report, 1 Jul. 1967–3 Jun. 1968
Louis R. Poulo and Sherwin Greenblatt Fort Monmouth, N.J. ECOM Apr. 1969 449 p refs
(Contract DAAB07-67-C-0520)
(AD-687311; ECOM-0520-F) Avail: CFSTI CSCL 10/2

A study of theoretical techniques applicable to the analysis and design of modern power processing equipment is presented. An organizational structure is developed which defines a meaningful partitioning of a power system into component blocks at various levels. Considerations relevant to the various levels of this structure, both at the block diagram and circuit level, are treated. These areas include discussions of device models, dc power output stages and basic power converter limitations. A survey of current computer programs applicable to the analysis and design electrical equipment is presented. Brief treatments of some mathematical techniques, including Hilbert transforms, describing functions, phase-plane analysis and stability criteria are given. The above theoretical tools are applied to the analysis of a practical power processor, and predicted characteristics compared with those observed in the laboratory. Bibliographies are provided for three areas: power processors, mathematical methods and computer aided design. Author (TAB)

N69-33741*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RICHARDSON DUSHMAN EQUATION NOMOGRAPH
Arthur L. Smith and Roland Breitwieser Jun. 1969 11 p refs
(NASA-TM-X-52626) Avail: CFSTI CSCL 09C

Nomographic solutions to the Richardson Dushman equation are presented. The nomographs have been scaled to meet the emission conditions of the emitter and the back emission condition of the collector. Values of work functions are presented at 20 °K

intervals in the temperature range from 600° to 2500°K. The current density ranges from 1×10^{-7} to 1×10^{2}. The reading error of work function was determined to be less than 0.01 V. Author

N69-33938 Safety in Mines Research Establishment, Buxton (England).
SOME ASPECTS OF THE DESIGN OF INTRINSICALLY SAFE CIRCUITS
D. W. Widginton 1968 25 p refs
(RR-256) Copyright. Avail: Issuing Activity 5s 6d

The basic information usually available to the circuit designer and the problems involved in the design of intrinsically safe circuits are discussed. Topics covered include the design of voltage stabilized dc and ac supplies; the design of inductive circuits, with and without protective shunts; and methods for assessing the effects of long interconnecting cables. A useful method of assessing the safety of certain circuits is to show that the circuit under consideration is less dangerous than another circuit, whose safety can be assessed in terms of the basic information available. Author

N69-33957*# TRW Systems, Redondo Beach, Calif. Space Sciences Lab.
AN ULTRA SENSITIVE MAGNETOMETER AND GRADIOMETER USING WEAKLY COUPLED SUPERCONDUCTORS
A. L. Morse and D. L. Judge *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 65–78 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 09C

Flux quantization and superconducting tunneling associated with very low saturation currents were used to design and construct highly sensitive magnetometers for determining magnetic gradients and higher multipole moments in the earth's magnetic field. Flux densities as low as 10^{-9} gauss have been detected with cryogenic magnetometers because weak interactions between electrons and crystal lattices produce a correlation in electron position and momentum which makes it impossible for one of these electrons to gain or lose less energy than required to remove it from the electron lattice. Superconducting circuits involving Josephson junctions were described by equations that state: (1) that the super current through a point junction is proportional to the discontinuity of the super wave function; (2) that the phase shift around any closed path lying within a superconductor must be $2\pi n$ where n is an integer; and (3) that the phase difference between two superconductors is arbitrary but the time rate of a change of the phase shift is proportional to the voltage difference between them. A superconductor combined with the Meissner effect makes it possible to construct nearly field free regions if sufficient magnetic shielding is provided. G.G.

N69-34043# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
SCHOOL OF ELECTRICAL ENGINEERING, PURDUE UNIVERSITY Semiannual Research Summary Report, Jul.–Dec. 1968
Dec. 1968 188 p refs
(Contract N00014-67-A-0226)
(AD-687482; SAR-9) Avail: CFSTI CSCL 9/3

Reviews are given of research reports in the fields of bioengineering, automatic control systems, electric power systems and energy conversion, electromagnetic fields, communications sciences, nonlinear circuits and systems, computers and automata, materials and electronic devices, and agricultural remote sensing. TAB

N69-34281# Sandia Corp., Albuquerque, N. Mex.
LOW-INDUCTANCE, VOLTAGE-IMPULSE SYSTEMS USING DIELECTRIC LIQUID SWITCHES: APPLICATION TO MEASUREMENTS OF CAPACITOR DISCHARGES AND POLARIZATION REVERSAL IN FERROELECTRICS
R. H. Plumlee and W. D. McLachlan Dec. 1968 51 p
(PB-182941; SC-RR-68-785) Avail: CFSTI CSCL 09C

Low-inductance voltage-impulse systems which employ dielectric liquid-filled switches are described. These systems are useful from 50V to at least 50kV. With over-all system rise times of a few nanoseconds, they handle discharge energies the order of 10 J (e.g. 800 micro C at 25 kV) and peak transient currents of several thousand amperes. Voltage and current wave forms generated in dielectric liquids and air with these fast systems typically show an oscillatory rising front composed of 2 to 3 cycles of oscillation with a period of approximately 2 nsec. This oscillation is probably determined by superposition of the RLC resonance of the system and a plasma resonance frequency of the arc initiated as the metal contacts approach closure. Author (USGRDR)

N69-34503# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrophysics.
TWO-VARIABLE SYNTHESIS OF RESISTIVELY TERMINATED CASCADES OF LOSSLESS TRANSMISSION LINES, SERIES INDUCTORS AND SHUNT CAPACITORS, AND MINIMUM GYRATOR SYNTHESIS OF CERTAIN LUMPED LOSSLESS N-PORTS
Dante C. Youla and Gary D. Ott Griffiss AFB, N.Y. RADC May 1969 170 p refs
(Contract F30602-69-C-0053)
(AD-688618; PIBEP-69-025; RADC-TR-69-131) Avail: CFSTI CSCL 9/5

The work consists of two parts. In Part 1, necessary conditions are derived for the driving point impedance function of a resistively terminated cascade of equal lengths of lossless transmission line, series inductors and shunt capacitors. Several approaches are presented which tend to indicate that the conditions are also sufficient. Sufficiency is actually proved for the special case of a resistively terminated cascade of no more than two equal lengths of lossless transmission line and shunt capacitors only. A numerical example is included which illustrates the synthesis procedure. In Part 2, the problem of realizing an arbitrary rational n x n regular parasunitary matrix, S(p), as the scattering matrix of a lossless n-port containing the minimum number of ideal gyrators is considered. The approach used is to try to generate a lossless reciprocal n + k port, N sub a, such that when the last k-ports of *N* are terminated in k/2 uncoupled ideal gyrators, the resulting n-port realizes S(p). The success of the approach is shown to depend upon the existence of an appropriate factorization of the skew-symmetric part of S(p). It is shown that a minimum gyrator synthesis is always possible for the special class of matrices having a skew-symmetric part which is non-singular for all p = jw, including p = jinfinity. A non-trivial numerical example of the synthesis technique is presented in an appendix. In addition, techniques for the minimum gyrator synthesis of arbitrary 2 x 2 and degree two n x n regular para-unitary matrices are presented. Author (TAB)

N69-34584# California Univ., Berkeley. Electronics Research Lab.
JOINT SERVICES ELECTRONICS PROGRAM Interim Report, 16 Mar. 1968 – 31 Jan. 1969
D. J. Angelakos and J. R. Whinnery Mar. 1969 82 p
(Grant AF-AFOSR-1488-68)
(AD-687892; ERL-69-1; AFOSR-69-0900TR) Avail: CFSTI CSCL 9/3

The report summarizes research conducted under the Joint Services Electronics Program within the Electronics Research

Laboratory, University of California, Berkeley during the period 15 March 1968 through 31 January 1969. Research project are described under the following headings: Bioelectronics; Electromagnetic radiation and propagation; Electron microscopy; Integrated circuits; Plasmas; Quantum and optical electronics; Solid-state and electron devices; and Systems and computer sciences. Author (TAB)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-33783# Metropolitan Washington Council of Governments, D.C.
AIR TRAVEL DEMAND IN THE WASHINGTON–BALTIMORE REGION, 1970–1990
1968 30 p
(PB-183060) Avail: CFSTI CSCL 01B

The report summarizes the air travel demand forecasts for the Washington–Baltimore Region by five-year intervals from 1970 through 1990. Commercial air passengers, commercial air cargo tonnage, and general aviation operations are all included. These forecasts provide a basis for analyzing the capacity characteristics of expansion plans proposed for existing airports and plans for new airports in the Washington–Baltimore Region. Author (USGRDR)

N69-33836# Tri-State Transportation Commission, New York.
IMPROVING ACCESS TO NEWARK AIRPORT
Feb. 1969 23 p Sponsored in part by the Bureau of Public Roads
(PB-182903; Rept-3020-6816-3C) Avail: CFSTI CSCL 13B

Because of its location in the center of a vast and elaborate transportation network in the meadowlands near the heart of the Tri-State Region, Newark Airport is near many rail lines and connects to many highway routes. The report considers an array of combinations that would connect downtown Newark to the new airport terminal by much improved rail and bus service. Of these, eight are selected as the most reasonable alternatives for deeper study. These eight alternatives are described. Author (USGRDR)

N69-33854# Massachusetts Inst. of Technology, Cambridge. Flight Transportation Lab.
A MULTI-REGRESSION ANALYSIS OF AIRLINE INDIRECT OPERATING COSTS
N. K. Taneja and R. W. Simpson Jun. 1968 119 p refs
(Contract C-136-66)
(PB-183012; R-67-2) Avail: CFSTI CSCL 15E

A multiple regression analysis of domestic and local airline indirect costs was carried out to formulate cost estimating equations for airline indirect costs. The costs were broken down into the classification of the uniform system of accounts Form 41, used by the airlines in reporting to the CAB. Thus regression equations were found for annual system expenses and annual station expenses. A stepwise regression technique is used to select the best combinations of independent variables for the equations. The independent variables were data such as revenue passenger miles, passengers enplaned, revenue aircraft miles, total revenue aircraft departures, etc. Author (USGRDR)

N69-33937# Federal Aviation Administration, Atlantic City, N.J. Dept. of Transportation.
SIMULATION TEST OF THE ARCATA, CALIFORNIA, DIAMOND RUNWAY CENTERLINE Interim Report
Guy S. Brown and Richard L. Sulzer Aug. 1969 26 p ref
(NA-69-9; RD-69-35) Avail: Issuing Activity

The guidance value of the Arcata diamond runway centerline paint markings was tested by comparison with the U.S. standard centerline markings in the Delta/P-3 visual simulation facility. Twenty experienced pilots participated in the testing. Results generally favored the U.S. standard centerline consisting of a 3 foot wide interrupted stripe with 120 foot painted length and 80 foot gaps, as opposed to the 10 foot maximum width diamonds with 75 foot length and spacing. The only exception was that the diamonds were seen farther away prior to touchdown, a result that is attributed to the one-third larger total painted area. Author

N69-34106*# Kaman AviDyne, Burlington, Mass.
COMPUTER SIMULATION MODEL OF TERMINAL AIR TRAFFIC AND PWI SYSTEMS, PHASE 1
J. Ray Ruetenik and John H. Thompson 28 Mar. 1969 104 p refs
(Contract NAS12-688)
(NASA-CR-86200; TR-57) Avail: CFSTI CSCL 01B

This report describes the collision avoidance system technical evaluation (CASTE) computer program developed for the simulation of proximity warning indicator (PWI) systems operating in air terminal traffic. The traffic model is comprised of measured flight tracks from the FAA Atlanta Airport Radar Terminal System facility and intruder tracks generated by program instructions. The program is designed to provide an evaluation of PWI system performance in the air traffic model by comparing the alarms produced to the collision hazards that exist. Author

N69-34197# ARO, Inc., Arnold Air Force Station, Tenn.
BOUNDARY INTERFERENCE AT SUBSONIC SPEEDS IN WIND TUNNELS WITH VENTILATED WALLS Final Report, Oct. 1966–Jan. 1968
M. Pindzola and C. F. Lo AEDC May 1969 135 p refs
(Contract F40600-68-C-0001)
(AD-687440; AEDC-TR-68-47) Avail: CFSTI CSCL 14/2

Equations and charts as obtained by theoretical analyses are presented for the evaluation of corrections which must be applied to test data as obtained from wind tunnels because of the presence of the test section boundaries. Results are presented for two-dimensional, circular, and rectangular tunnels with boundaries of the completely closed, completely open, slotted, or perforated variety. Interference factors accounting for the direct effects of model and wake blockage on the longitudinal velocity and of model lift on the upwash velocity are enumerated. In addition, consideration is given to the variation of the longitudinal and vertical velocity components along the tunnel axis leading to buoyancy and streamline-curvature corrections. Author (TAB)

N69-34285# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
DESIGN PERFORMANCE AND OPETIONAL CHARACTERISTICS OF THE ARL COMPONENT TEST FACILITY Final Report
Eric G. Friberg and Derek G. Moore Jan. 1969 68 p refs
(AD-687861; ARL-69-0007) Avail: CFSTI CSCL 14/2

The document covers a versatile, small-scale test-rig for the evaluation and study of new technologies for basic wind tunnel components. The report describes the facility and its operation.

Design calculations are given for the facility from Mach 5 to 12 at pressures up to 3000 psia. Theoretical calculations are compared to actual test calibration results at nominal Mach numbers of 6, 8, 10, and 12. Author (TAB)

N69-34300# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.

OPERATING CHARACTERISTICS OF A MULTI-MEGAWATT ARC HEATER USED WITH THE AIR FORCE FLIGHT DYNAMICS LABORATORY 50-MEGAWATT FACILITY Technical Report, Sep. 1967–Dec. 1968

Richard T. Smith and James L. Folck Apr. 1969 70 p refs

(AD-687880; AFFDL-TR-69-6) Avail: CFSTI CSCL 14/2

The operational capabilities of a 50-megawatt arc heater facility are discussed. The operating characteristics of the heater with throat diameters of one inch and two inches are reported. Design modifications made to the heater during the course of this investigation extended the usable power limit to approximately 35 megawatts at a stagnation pressure in excess of 100 atmospheres. Representative flow surveys are presented of the pitot pressure and stagnation point heat transfer rate which were obtained at the exit of a two-foot diameter nozzle. Author (TAB)

N69-34494# American Science and Engineering, Inc., Cambridge, Mass.

RESEARCH AND CONSTRUCTION OF A MECHANICALLY ACCELERATED SABOT SYSTEM FOR THE PRODUCTION OF INTENSE MOLECULAR BEAMS Final Report, 22 May 1967–31 Dec. 1968

John E. Jordan and Orr Shepherd May 1969 103 p refs

(Contract F19628-67-C-0352)

(AD-688620; ASE-2201; AFCRL-69-0095) Avail: CFSTI CSCL 14/2

An experimental investigation has been undertaken of the Mechanically Accelerated Sabot System (MASS) which holds the promise of producing a molecular beam in the intermediate energy region. Apparatus has been constructed which permits the firing, in vacuum, a hollow, gas filled projectile from a high speed rifle. Provision has been made for localizing the combustion gases to prevent contamination of the main vacuum chamber in which the high speed projectile is opened in flight and the gas released. Several projectile designs and opening devices were investigated. The projectile velocity was measured and photographs were made at several points along the projectile path. Photographs of the projectile opening process were used in an extensive study to determine a means of effecting the release of the gas sample cleanly and without disturbance. After the gas is released from the projectile, it propagates down range as an expanding cloud and the pressure pulses were observed as the cloud passes several ion gauge stations. Although it was not possible in the time alloted to collimate the gas cloud into a useable molecular beam, it is concluded that the technique can be made successful, at least for velocities of a few km/sec. Author (TAB)

N69-34842# Junta de Energia Nuclear, Madrid (Spain). Div. de Medicina y Proteccion.

DESIGN OF RADIOISOTOPIC LABORATORIES [PROYECTO DE LABORATORIOS DE RADIOISOTOPOS]

Sergio Gargia-Orcoyen Tormo [1968] 7 p In SPANISH Presented at the Symp. on Appl. of Radioisotopes, Madrid, 19–21 Jun. 1967

(CONF-670649-39) Avail: AEC Depository Libraries

Laboratories with open sources can be divided into three types according to the activity of the source-very high, high, and medium. The various construction aspects with specific characteristics according to the type of laboratory were reported. Some consideration is given to the laboratory installations. Contamination and decontamination are discussed, including limiting values of surface contamination necessary to control the radiation dose to the laboratory workers. Author (NSA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-33261*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CAVITATION PERFORMANCE OF LINE-MOUNTED 80.6 DEG HELICAL INDUCER IN HYDROGEN

Royce D. Moore and Phillip R. Meng Washington Aug. 1969 20 p refs

(NASA-TM-X-1854) Avail: CFSTI CSCL 20D

The noncavitating and cavitating performance of a line-mounted 80.6° helical inducer was determined in hydrogen over a liquid temperature range of 34.1° to 42.2° R (18.9 to 23.4 K) and a flow coefficient range of 0.08 to 0.12 at rotative speeds of 25,000 and 30,000 rpm. The tank pressure requirement for this line-mounted inducer was compared with that for the same inducer closely coupled to the tank. The tank pressure requirement was determined to be greater for the line-mounted inducer. Inducer net positive suction head requirement increased with increasing flow coefficient and rotative speed and decreased with increasing temperature. Noncavitating head-rise coefficient, which decreased with increasing flow coefficient, was unaffected by temperature and rotative speed. Author

N69-33284# Naval Oceanographic Office, Washington, D.C.

THE METHOD OF STUDYING INTERNAL WAVES IN THE BLACK SEA [K METODIKE IZUCHENIYA VNUTRENNIKH VOLN V CHERNOM MORE]

Ya. K. Gololobov 1969 10 p refs Transl. into ENGLISH from Tr. Azovo-Chernomorsk. Nauchn.-Issled. Inst. Morsk. Rybn. Khoz. i Okeanogr. (Moscow), no. 23, 1964 p 49–54

(AD-685261; NOO-TRANS-408) Avail: CFSTI CSCL 20/4

The existing method used for the determination of internal wave characteristics, notably their height, by means of data on water temperature and salinity variations cannot be recommended for the deep portion of the Black Sea because the errors that are introduced may exceed several times the actual wave height. It has been established that for the study of internal waves in the Black Sea one should make use of data on the vertical distribution of alkalinity at diurnal and multidiurnal stations. Author (TAB)

N69-33286# Watervliet Arsenal, N.Y. Benet Labs.

CHARACTERISTICS OF FLUIDIC PROPORTIONAL AMPLIFIERS

Kay Yong and Ronald J. Laspisa Feb. 1969 53 p

(AD-687288; WVT-6908) Avail: CFSTI CSCL 13/7

Characteristic operating curves of several specific fluidic proportional amplifiers have been obtained experimentally and are presented. Data included are very extensive, to provide the reader with a complete source of device characteristics. Also, the use of these curves to cascade amplifiers as a necessary part of system design is discussed. Author (TAB)

N69-33292*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THEORETICAL ANALYSIS OF THE STARTING PROCESS IN THE LUDWIEG TUBE

John D. Warmbrod and Heinz G. Struck *In its* Res. Achievements Rev., Vol. 3 1968 p 17-24 refs (See N69-33289 19-31)
Avail: CFSTI CSCL 20D

A theoretical analysis, assuming quasi-one-dimensional flow through a duct, was undertaken to better understand the time-dependent flow phenomenon that takes place in a shock tube wind tunnel during the early development of the flow. Wave interactions and boundary conditions which can occur in a one-dimensional time-dependent flow, such as shock formation, shock-shock interactions, and shock-contact surface interactions are discussed. Theoretical results are compared with experimental data from a pilot model of the large scale wind tunnel. Agreement between theory and experiment was good when considering the assumptions made for the theoretical model. Author

N69-33301# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

MEASUREMENT OF TURBULENCE IN THREE-DIMENSIONAL MEAN FLOW

S. P. S. Arya and J. E. Cermak Apr. 1969 31 p refs
(Contract N00014-68-A-0493)
(AD-686488; CER68-69SPSA-JEC30; THEMIS-CER-TR-2) Avail: CFSTI CSCL 20/4

A hot-wire anemometer technique for measuring turbulence in three-dimensional mean flow is presented. Effect of three-dimensionality of mean flow on a yawed wires sensitivity to longitudinal, vertical and lateral fluctuations is brought out. A four-wire probe is shown to be suitable for measuring all the mean flow and turbulent quantities of interest. Errors due to the cross flow component on turbulence measurements in two dimensional flows using conventional hot-wire techniques are estimated. Measurements of shear are shown to be very sensitive to even small amounts of cross flow that might be present in many laboratory and field flows of interest. Author (TAB)

N69-33353*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL AND THEORETICAL TURBULENT BOUNDARY LAYER DEVELOPMENT IN A MACH 4.4 WATER-COOLED CONICAL NOZZLE

Donald R. Boldman, James F. Schmidt, and Robert C. Ehlers Washington Aug. 1969 43 p refs
(NASA-TN-D-5377) Avail: CFSTI CSCL 20D

Boundary layer temperature and velocity measurements were obtained at three stations in the supersonic portion of a 30°-50° C-D cooled nozzle operating with an adiabatic and a cooled inlet. Tests were performed with heated air at nominal Mach numbers 2.1 to 4.4. The ratio of wall-to-stagnation temperature was 0.8 at Mach 2.1 and 0.6 at Mach 4.4. The results indicated that the thermal boundary layer in supersonic flow was not described by a 1/7 power law. The experimental momentum and displacement thicknesses compared favorably to predictions based on the integral boundary layer theories. Author

N69-33378# Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.

PRESENTATION AND DISCUSSION OF MEASUREMENT RESULTS OF THE VELOCITY OF SLIPPERY GAS BUBBLES IN A LIQUID MEDIUM BY DIFFERENT METHODS [PRESENTATION ET DISCUSSION DES RESULTATS DE MESURES DE VITESSE DE BULLES GAZEUSES GLISSANTES DANS UN MILIEU LIQUIDE OBTENUS PAR DIFFERENTES METHODES]

A. Campanile, G. Galimi, M. Goffi, U. Magrini (Genoa Univ.), and C. Pisoni (Genoa Univ.) 1968 10 p refs In FRENCH Presented at 7th Euromech Conf. on Fluid Mechan., Grenoble, France, 23-26 Apr. 1968
(SORIN-145) Avail: CFSTI

Comparisons are made of the different methods used to measure the velocity of gas bubbles in a liquid medium. Of the methods compared, the radioactivation method did not appreciably change the physical and chemical properties of the gas which influences the bubble movement. The results provide for this technique to be employed on outflowing argon bubbles in stagnant water. Transl. by E.H.W.

N69-33421*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LINEARIZED THEORY OF STAGNATION POINT HEAT AND MASS TRANSFER AT HYPERSONIC SPEEDS

Kenneth K. Yoshikawa Washington Aug. 1969 35 p refs
(NASA-TN-D-5246) Avail: CFSTI CSCL 20D

An explicit closed-form solution has been obtained for the compressible, viscous shock-layer energy equation with mass addition or suction. The solution is applicable at very high speeds, when the interactions between the heated gas behind the shock wave and the layer of injected or ablated gases from the surface must be considered as well as the effect of heat conduction across the shock layer. The solution consists of the energy equation decoupled from the other conservation equations and then linearized by the introduction of constant values for the thermal and transport properties. Results of using the solution show explicitly that the effect of gas injection on convective heat transfer depends on the Stanton number without mass addition and on the relative molecular weights, and thermal and transport properties of the free-stream and injected gases. The solution is substantiated by comparisons with more exact solutions. Author

N69-33571# Centre National de la Recherch Scientifique, Meudon (France) Laboratoire d'Aerothermique.

CONTRIBUTION TO THE STUDY OF ISOTHERMAL MOVEMENTS OF WATER IN POROUS MATERIALS [CONTRIBUTION A L'ETUDE DES MOUVEMENTS ISOTHERMES DE L'EAU DANS LES MILIEUX POREUX]

Ali Belghith May 1969 84 p refs In FRENCH *Its* Publ. No. 337
(Rept-69-1) Avail: CFSTI

Theory and experimental work is presented on isothermal movement. Emphasis is placed on the variations of total diffusion as a function of the temperature and on the examination of the diffusions due to the liquid and vapor phases. Mathematical solutions are also given. Transl. by E.H.W.

N69-33572# Centre National de la Recherche Scientifique, Meudon (France). Laboratoire d'Aerothermique.

CONTRIBUTION OF THE THERMOMIGRATION OF WATER IN POROUS MATERIALS [CONTRIBUTION A L'ETUDE DE LA THERMOMIGRATION DE L'EAU DANS LES MILIEUX POREUX]

Mohamed Masladj Nov. 1968 72 p refs In FRENCH *Its* Publ. No. 334
(Rept-68-6) Avail: CFSTI

The principal results found were concerned with the changes of temperature fields, and the concentration of water samples in the soil from which the flow is checked by the extremities of temperature differences. Numerical values were calculated for thermomigration. Transl. by E.H.W.

N69-33729# Royal Aircraft Establishment, Farnborough (England).
BOUNDARY CONDITIONS IN THE PRESENCE OF OBLIQUE REACTION WAVES IN SUPERSONIC FLOW [RANDBEDINGUNGEN BEI SCHIEFEN REAKTIONSFRONTEN IN UBERSCHALLSTROMUNG]
Fritz Bartlma Apr. 1969 22 p refs Transl. into ENGLISH from Z. Flugwiss. (Brunswick, W. Germany), v. 16, no. 12, 1968 p 437–444
(RAE-LIB-Trans-1358) Avail: CFSTI

A reaction wave is defined as a zone of finite thickness with heat addition or subtraction caused by a chemical reaction. The flow is deflected in the case of an oblique reaction wave. In spite of this fact, the boundary conditions at a wall in a supersonic flow can be satisfied by merely gasdynamic considerations without assuming separation of the flow. This is shown for some typical cases. Author

N69-33783# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
DUSTY HYPERSONIC FLOWS
Ronald F. Probstein and Franco Fassio Mar. 1969 46 p refs
(Contract Nonr-1841(93))
(AD-687710; PUB-69-2) Avail: CFSTI CSCL 20/4

A study of the motions of solid particles in a dusty gas in the inviscid hypersonic shock layers of slender wedges and cones and the stagnation regions of cylinders and spheres is carried out. Particles of uniform size and with a size distribution are considered. Analytic drag laws for the particles are used for the cases of low, intermediate, and high particle Reynolds numbers. For a uniform particle size cloud the collection efficiency is shown to be expressible in terms of a single parameter embodying the particle characteristics, shock strength, and wedge or cone angle. In the case of the stagnation region solutions there is a corresponding similarity law but it is shown not to depend on the explicit form of the drag law or whether the flow is plane or axisymmetric. It is shown that when the appropriate similarity parameter is around one the collection efficiency rises rapidly from zero to one, with the rise almost discontinuous in the stagnation region cases. With a particle size distribution there is found to be very little deviation from the uniform size results at high Reynolds number and only small departures for other Reynolds number ranges. Author (TAB)

N69-33811# Royal Aircraft Establishment, Farnborough (England).
TABLES OF SOME SUPERSONIC GAS FLOW FUNCTIONS
R. Walton Oct. 1968 25 p ref
(RAE-TR-68245) Copyright. Avail: CFSTI

Tables have been prepared of some supersonic gas flow functions in the Mach number range of 1 to 10 for a gamma from 1.05 to 1.6. Author (ESRO)

N69-33848# California Univ., Berkeley. Div. of Applied Mechanics.
A MIXTURE OF ELASTIC CONTINUA
A. E. Green and P. M. Naghdi Apr. 1969 16 p refs
(Contract N00014-67-A-0114)
(AD-687707; AM-69-7) Avail: CFSTI CSCL 20/4

For a mixture of chemically inert elastic continua, constitutive equations are discussed which are nonlinear functions of temperature and kinematical variables for each constituent but are linear functions of degree one in temperature gradient and velocity differences. Author (TAB)

N69-33911# Army Foreign Science and Technology Center, Washington, D.C.
INERTIAL MECHANISM OF SETTLING OF COARSELY DISPERSED AEROSOL ON TERRESTRIAL VEGETATION
V. F. Dunskii 1969 18 p refs Transl. into ENGLISH from the book "Voprosy Atmosfernoi Diffuzii i Zagryazneniya" Leningrad, Tr. Gl. Geofiz. Observ. no. 172, 1965 p 183–191
(AD-687502; FSTC-HT-23-627-68) Avail: CFSTI CSCL 4/2

The document presents an analysis of experimental data on the scattering of drops of liquid in the atmosphere is used as the basis for demonstrating the necessity of considering the inertial settling of aerosols on terrestrial vegetation. A method is proposed for estimating the inertial settling in a study of the atmospheric diffusion of coarsely dispersed aerosols. Author (TAB)

N69-33914# California Univ., Berkeley. Aeronautical Sciences Div.
SUPERSONIC LAMINAR BOUNDARY LAYER SEPARATION NEAR A COMPRESSION CORNER
A. A. Sfeir (Ph.D. Thesis) Mar. 1969 89 p refs
(Grant AF-AFOSR-268-68)
(AD-687483; AS-69-6) Avail: CFSTI CSCL 20/4

Detailed measurements were performed in the region of interaction of a laminar boundary layer with a compression corner at Mach numbers near 2.5. Different models were tested permitting variation in the angle of compression and the conditions downstream of reattachment. The heat flux and the resistance of equilibrium of a hot wire anemometer at any location in the flow field were measured. These measurements were supplemented by either the wall or the pitot pressure to compute all thermodynamic and dynamic variables. The results permitted verification of the hypothesis of zero normal pressure gradients when the compression angle is small and the boundary layer is laminar. The enthalpy in the separated bubble was constant and equal to the wall enthalpy of a flat plate with attached laminar boundary layer at the same Mach number. Evidence of a reversed flow with velocities approximately 5% of the free stream velocity was observed. The recompression along the separating streamline was found to be very nearly isentropic. Critical points were located in the reattachment region and a physical explanation proposed with special emphasis on the location of transition. Author (TAB)

N69-33920# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.
AN INVESTIGATION OF THE INSTABILITY OF A LAYER OF FLUID HEATED FROM BELOW USING THE LIAPUNOV FUNCTIONAL METHOD
T. V. Davies Dec. 1967 17 p refs
(Grant NSF GK-946)
(Rept-1251) Avail: Issuing Activity

A simple problem of instability onset is investigated: the fluid is subjected to differential heating and it has two free bounding surfaces. The aim is to apply the Liapunov functional method to determine the criterion for instability. In the classical treatment of the problem, it is assumed that there is a linear variation of temperature in the fluid before the onset of convectional instability. By applying this new technique, it is not necessary to assume such a constant lapse rate of temperature. Considerable use is made of a work in which the Liapunov functional method is applied to the stability problem of an elastic plate. Author

N69-33931# Notre Dame Univ., Ind. Coll. of Engineering.
STRUCTURE OF TURBULENT FREE-CONVECTION BOUNDARY LAYERS ALONG A VERTICAL PLATE
K. T. Yang and V. W. Nee Apr. 1969 60 p refs
(Contract N00014-68-A-0152)
(AD-687769; THEMIS-UND-69-1) Avail: CFSTI CSCL 20/4

A non-local differential phenomenological theory for turbulent free-convection boundary layers along a two-dimensional heated vertical plate is described, in which both eddy viscosity and eddy thermal diffusivity are considered unknown. The total viscosity (molecular plus eddy) is taken to be governed by a parabolic rate equation which takes into account turbulent convection, diffusion, generation and decay, while the turbulent thermal diffusivity is based on a constant turbulent Prandtl number. Based on this closed system of partial differential equations, the mean velocity and temperature field as well as the eddy viscosity and the turbulent thermal diffusivity distribution can be mapped out. It is shown for the vertical-plate problem that the generation of turbulence is essentially shear induced, and that the gravity force only influences the mean velocity and temperature fields. A degenerated local theory is developed to interpret and compare with existing experimental data. Calculations show that the turbulent free-convection boundary layer consists essentially of three distinct regions, namely, the viscous sublayer, the inner layer, and the outer layer. The viscous sublayer defined by vanishing eddy viscosity, is shown to have a nonlinear velocity distribution. The inner layer is dominated by the balance of turbulent generation and decay. The outer layer is governed mainly by turbulent convection and diffusion. It is shown that Corrsins viscous superlayer also exists in the turbulent free-convection case and that temperature fluctuations tend to reduce the sharpness of the turbulent-non-turbulent interface. It has also been found that Grashof number has strong effects on turbulent generation and decay. Author (TAB)

N69-33935# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

ON-LINE COMPUTER ANALYSIS OF TURBULENCE DATA WITH THE FAST FOURIER TRANSFORM METHOD

Yih-Ho Pao, S. D. Hansen, and G. R. MacGregor Jun. 1969 36 p refs

(D1-82-0863) Avail: CFSTI

Turbulence signals from linearized hot wire anemometers are sent directly to an IBM 360-44 digital computer with an IBM 1827 analog to digital converter. The analog signals are converted to digital form and analyzed by means of the fast Fourier transform algorithm to obtain mean velocities, turbulence intensities, auto-spectra and auto-correlations. Sample auto-spectral and auto-correlation measurements in a two dimensional turbulent mixing layer are shown. These results are obtained by analyzing 1,600,000 data points. Author

N69-34041# Wisconsin Univ., Madison. Mathematics Research Center.

ON THE CONSTRUCTION OF MOTIONS WITH CONSTANT STRETCH HISTORY. PART 1: SUPERPOSABLE VISCOMETRIC FLOWS Technical Summary Report

R. R. Huilgol Dec. 1968 57 p refs

(Contract DA-31-124-ARO(D)-462)

(AD-687459; MRC-TSR-954) Avail: CFSTI CSCL 20/4

The article describes a method for generating non-viscometric motions with constant stretch history by superposing viscometric flows. Motions of the types (2) and (3) on NOLL'S list are found in this manner and experiments are suggested to discover these material functions. The effects of superposing rigid motions on the above flows are also found. Author (TAB)

N69-34042# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

TABLES OF BLAST WAVE PARAMETERS. PART 1: SPHERICAL EXPLOSIONS Final Report

John W. Gorsh and Robert G. Dunn Jan. 1969 75 p refs

(AD-687883; ARL-69-0011-Pt-1) Avail: CFSTI CSCL 19/8

The motion of the spherical shock wave and the distribution of the flow quantities behind the wave for the case of a strong shock have been calculated. These have been obtained in the form of similarity solutions, which implies that the form of the disturbance at any time is similar to its form at any previous time. An important feature of the problem is that the similarity solutions at the shock front are only satisfied by the Rankine-Hugoniot relations in the limit of infinite shock strength. The report contains a numerical compilation of functions defining the pressure, density, velocity, and energy within a spherical blast wave. Author (TAB)

N69-34071# Rocketdyne, Canoga Park, Calif.

THE EFFECT OF CHARGE TRANSPORT ON THE DISINTEGRATION OF LIQUID JETS Interim Technical Report, 1 Jun. 1968–May 1969

A. L. Huebner May 1969 58 p refs

(Contract N00014-67-C-0474)

(AD-687743; R-7880) Avail: CFSTI CSCL 20/4

Examination of disintegration processes occurring with charged liquid jets has continued. Jets of various Freon blends were employed to establish the range of liquid electrical conductivity for which specifically electrical influences on jet disintegration and drop formation occur. The study also provided additional data to supplement analysis of jet instability configurations and to facilitate extension of the theory of electrified jets. A general analysis of the instabilities associated with electrified jets was accomplished. Comparison of this theory was made with the limiting axisymmetric case ($m = 0$) for which analysis had already been developed. Computations were also carried out for nonaxisymmetric cases, and comparison made with experimentally obtained results. Finally, apparatus for the determination of self-charging of low conductivity liquids in complex flow systems was designed. Fabrication of this apparatus was completed. Author (TAB)

N69-34091# Lockheed Missiles and Space Co., Palo Alto, Calif.

HYPERSONIC GAS FLOW AROUND BLUNT BODIES TAKING ACCOUNT OF SELECTIVE RADIATION AND ABSORPTION OF ENERGY

V. I. Lebedev et al [1969] 10 p refs Transl. into ENGLISH from Vychislitelnaya Mat. i Mat. Fiz. (Moscow), v. 9, no. 3, 1969 p 655–663

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The solution of the problem of hypersonic radiating gas flow around a blunt body was examined. The method of integral relations was utilized as the computational gasdynamic scheme. The problem was solved in the approximation of an optically thin gas (volume de-excitation). An approximate computation scheme is demonstrated which imposes no constraint on the optical thickness of the gas, and in which radiation transport is taken into account more rigorously by means of a differential approximation, and which permits consideration of energy absorption as well as radiation by the gas. In connection with the fact that real gases selectively radiate and absorb energy as a rule, the dependence of the gas absorption coefficient on not only the pressure and temperature, but also on the frequency, is taken into account. Author

N69-34093# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.

VISCOUS EFFECTS OF BLUNT CONES AT LOW REYNOLDS NUMBERS AND HYPERSONIC SPEEDS Final Report, Dec. 1967–Jan. 1968

G. M. Gregorek Wright-Patterson AFB, Ohio ARL Jan. 1969 134 p refs

(Contract F33615-68-C-1220)

(AD-687860; ARL-69-0006) Avail: CFSTI CSCL 20/4

Pressure and heat transfer rates on spherically-blunted 10 and 25 deg half angle cones at zero angle-of-attack were measured in a continuous flow hypersonic wind tunnel. At a nominal Mach number of 10, and Reynolds number between 3500 and 9700, based on free stream conditions and nose diameter, measured surface pressures were as high as 25% above the values predicted by solutions from the method of characteristics. A Tangent-Blunt-Cone analysis was formulated by coupling a local similarity boundary layer theory with the inviscid blunt cone solutions; use of this theory improved predictions to boundary layer theory at the higher stream densities; however, at Re < 5000, corrections to account for transverse curvature on the 10 deg cone and stream vorticity on the 25 deg cone were required to bring predicted and observed values into agreement. Author (TAB)

N69-34122# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
FLUCTUATION ANALYSIS IN SIMPLE FLUIDS
A. Z. Akcasu and E. Daniels Jul. 1969 50 p refs
(Grant NSF GK-1009)
(Rept-08034-5-T) Avail: Issuing Activity

Generalized Langevin theory is applied to the analysis of fluctuations in simple fluids. Formulas for the current–current and density–density correlation functions are developed. More importantly, they are developed for a region of frequencies ($\omega \approx 10^{13}$ sec^{-1}) and wave vectors ($k \approx 10^{8}$ cm^{-1}) which are explored in typical slow neutron scattering measurements. Where applicable, comparisons are made with the results of the numerical calculations carried out by Rahman, and good agreement is generally found. Author

N69-34194# California Inst. of Tech., Pasadena. Firestone Flight Sciences Lab.
LAMINAR INCOMPRESSIBLE WAKE BEHIND A FLAT PLATE
Denny R. S. Ko, Toshi Kubota, and Lester Lees 15 Apr. 1969 59 p refs
(Contract DA-31-124-ARO(D)-33; Proj. Defender)
(AD-687771; Memo-72) Avail: CFSTI CSCL 20/4

An integral method is used to investigate the interaction between the stability of a single frequency finite amplitude disturbance with the non-parallel mean flow in a laminar, incompressible wake behind a flat plate. The mean flow is assumed to be characterized by a few shape parameters. The integrals involving the fluctusting components are determined as functions of those shape parameters by solving the inviscid Rayleigh equation of the linear stability theory using the local mean flow. The variations of the amplitude of the fluctuation and the mean flow in the streamwise direction are then determined from solving the set of ordinary differential equations. The effect of coupling between the mean flow and the fluctuation was found to be very important. Author (TAB)

N69-34212# Bristol Siddeley Engines, Ltd. (England). Advanced Propulsion Research Group.
THE CALCULATION OF HEAT TRANSFER CONTROLLED DROPLET EVAPORATION
R. J. Clifford Aug. 1967 43 p refs
(Contracts KG/2G/82; KG/2G/85)
(AP-5489) Avail: CFSTI

Equations were developed for a single droplet traveling one dimensionally in a gas stream of constant velocity and successfully established in an autocode computer program. A survey was conducted considering kerosene droplets in airstreams with variation of temperature, pressure and velocity expected in present and future engines. A single condition was calculated for a Shelldyne droplet in an airstream. It was found that the Shelldyne droplet traveled about two and half times as far as a kerosene droplet of the same diameter before it had fully evaporated. Author

N69-34215# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
ON THE PREDICTION OF LAMINARISATION
B. E. Launder and W. P. Jones Aeron. Res. Council 1969 28 p refs Supersedes ARC-30067
(ARC-CP-1036; ARC-30067) Copyright. Avail: CFSTI; HMSO 6s 6d

In rapid acceleration it is known that an originally turbulent boundary layer may undergo a partial or complete decay to laminar; a phenomenon known as laminarisation. The report distinguishes between 'moderate' and 'severe' accelerations. For the former, the sublayer of the boundary layer remains essentially turbulent. For the latter, a complete degeneration to laminar flow will take place if the acceleration continues over a sufficient distance. Two simple models have been proposed for the variation of turbulent shear stress, according to whether the acceleration is 'moderate' or 'severe'. These models have been incorporated into the finite difference prediction procedure of Patankar and Spalding and comparison made with a limited number of experiments. Agreement with experiment is reasonably good and progress to date has been sufficiently encouraging to suggest that the accurate prediction of laminarisation is now an attainable objective. Author (ESRO)

N69-34251# Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Bochum (West Germany).
CONFERENCE PROCEEDINGS OF THE WGLR COMMITTEE FOR AERODYNAMICS [BERICHT UEBER DIE SITZUNG DES WGLR-FACHAUSSCHUSSES FUER AERODYNAMIK]
Sep. 1968 228 p refs In GERMAN Conf. held in Göttingen, Ger., 18 Jan. 1968
(DLR-MITT-68-33) Avail: CFSTI

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7. EXPERIENCE WITH NUMERICAL SOLUTION OF HYPERSONIC BOUNDARY LAYER EQUATIONS S. Lin (DVL), W. Schoenauer, H. Spreuer, and E. Adams (Tech. Hochschule) p 167–171 refs (See N69-34258 19-12)

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9. INTEGRATION PROCESS FOR THE COMPUTATION OF INCOMPRESSIBLE OSCILLATING BOUNDARY LAYERS I. Teipel (Deutsche Versuch. fur Luft- und Raumfahrt) p 219–232 refs (See N69-34260 19-12)

N69-34252# Aerodynamische Versuchsanstalt, Göttingen (West Germany).
ON THE RELATION BETWEEN THE LOCAL SKIN FRICTION COEFFICIENTS OF A TURBULENT BOUNDARY LAYER IN COMPRESSIBLE AND INCOMPRESSIBLE FLOW [UEBER DEN ZUSAMMENHANG ZWISCHEN DEN OERTLICHEN REIBUNGSBEIWERTEN TURBULENTER GRENZSCHICHTEN BEI INKOMPRESSIBLER UND KOMPRESSIBLER STROEMUNG]
J. C. Rotta *In* WGLR Conf. Proc. of the WGLR Comm. for Aerodyn. Sep. 1968 p 11–55 refs In GERMAN (See N69-34251 19-12)
Avail: CFSTI

A rule is given by which the law for local skin friction in incompressible flow can be applied in compressible flow conditions. Results obtained from the application of the rule are compared with available test results and discussed. Author (ESRO)

N69-34253# Technische Univ., Berlin (West Germany). Hermann-Föttinger-Inst. für Ströemungstechnik.
EXACT SOLUTION OF THE STOKES EQUATION WITH BOUNDARY LAYER CHARACTERISTICS [EXAKTE LOESUNGEN DER STOKESSCHEN GLEICHUNGEN MIT GRENZSCHICHTCHARAKTER]
H. Schade *In* WGLR Conf. Proc. of the WGLR Comm. for Aerodyn. Sep. 1968 p 56–69 refs In GERMAN (See N69-34251 19-12)
Avail: CFSTI

The solutions of the Navier-Stokes equation are usually determined by the nonlinear characteristics of its convective terms. However, there is a group of solutions in which these convective terms are unimportant. Three such cases are discussed and solutions of the equations are given. These solutions are then compared with available experimental data and found to be in good agreement. Author (ESRO)

N69-34254# Technische Hochschule, Karlsruhe Univ. (West Germany).
SOLUTIONS OF NAVIER-STOKES EQUATION WITH INTEGRAL CONDITIONS [ERGEBNISSE AUS INTEGRALBEDINGUNGEN ZUR NAVIER-STOKESSCHEN GLEICHUNG]
L. Gerking *In* WGLR Conf. Proc. of the WGLR Comm. for Aerodynamics Sep. 1968 p 70–78 refs In GERMAN (See N69-34251 19-12)
Avail: CFSTI

The method of integral conditions has been successfully used in the boundary layer theory to solve the Prandtl equation and the same procedures can also be applied to flow with turbulent boundary layer as the semi-empirical law for the shearing stress curve appears in the solution. The same method may also be applied to axisymmetric incompressible flow. It is shown that the treatment of the flow field using integral conditions represents not only a method for showing the Navier-Stokes equation but provides a tool of basic importance. ESRO

N69-34255# Technische Hochschule Aachen (West Germany). Inst. für Allgemeine Mechanik.
SECOND ORDER SIMILARITY BOUNDARY LAYER SOLUTIONS FOR CAMBERED WALLS TAKING INTO CONSIDERATION INDRAFT AND BLEEDING [AEHNLICHE GRENZSCHICHTLOESUNGEN ZWEITER ORDNUNG FUER GEKRUEMMTE WAENDE UNTER BERUECKSICHTIGUNG VON ABSAUGEN UND AUSBLASEN]
F. Schultz-Grunow and H. Henseler *In* WGLR Conf. Proc. of the WGLR Comm. for Aerodyn. Sep. 1968 p 79–96 refs In GERMAN (See N69-34251 19-12)
Avail: CFSTI

The second order equations for steady plane incompressible laminar flow along a longitudinally combined wall are presented and solved by introducing a flow function. The differential equation arrived at can be solved on a digital computer by the Runge-Kutta method. ESRO

N69-34256# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Inst. für Angewandte Gasdynamik.
ENTRANCE LENGTH IN CHANNELS OF VARIABLE CROSS SECTION [ANLAUFSTROEMUNG IN KANAELEN VERAENDERLICHEN QUERSCHNITTS]
Martin Fiebig *In* WGLR Conf. Proc. of the WGLR Comm. for Aerodyn. Sep. 1968 p 97–121 refs In GERMAN; ENGLISH summary (See N69-34251 19-12)
Avail: CFSTI

The method to calculate the hydrodynamic entrance length in channels of constant cross-section by Sparrow, Lin and Lundgren is extended to allow the calculation of hydrodynamic entrance lengths in channels of varying cross- section. For this extension a different physical interpretation of the method is necessary. The basic assumption is that a fully developed flow will develop far downstream from the entrance section. The method allows specification of an arbitrary initial velocity profile, and guarantees that the velocity distribution satisfies the integrated continuity, axial momentum, and mechanical energy equation, and develops continuously into the asymptotic profile. Author (ESRO)

N69-34257# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Inst. für Angewandte Gasdynamik.
COMPUTATION OF LAMINAR INCOMPRESSIBLE BOUNDARY LAYER BY MEANS OF AN IMPLICIT DIFFERENCE PROCESS [BERECHNUNG LAMINARER KOMPRESSIBLER GRENZSCHICHTEN MITTELS IMPLIZITER DIFFERENZENVERFAHREN]
E. Krause *In* WGLR Conf. Proc. of the WGLR Comm. for Aerodynamics Sep. 1968 p 122–156 refs In GERMAN (See N69-34251 19-12)
Avail: CFSTI

An implicit quadrature process for the solution of the boundary layer equations in laminar incompressible flow is described. The process allows for arbitrary initial profiles for the tangential velocity component profile and the static temperature and permits discontinuities in the initial and boundary conditions. The process is applied to special cases: effect of a free flow jet on the boundary layer, influence of pulsed oscillations on shear stress distribution, wall cooling by tangential cold jet, suppression of boundary layer separation by accelerating the wall flow. ESRO

N69-34258# Technische Hochschule, Karlsruhe (West Germany).
EXPERIENCE WITH NUMERICAL SOLUTION OF HYPERSONIC BOUNDARY LAYER EQUATIONS [ERFAHRUNGEN BEI DER NUMERISCHEN LOESUNG DER HYPERSCHALLGRENZSCHICHTGLEICHUNGEN]
W. Schönauer, H. Spreuer, E. Adams, and Sui Lin *In* WGLR Conf. Proc. of the WGLR Comm. for Aerodyn. Sep. 1968 p 157–171 refs In GERMAN (See N69-34251 19-12)
Avail: CFSTI

Equations for solving boundary layer equations in ionized air as they appear at reentry into the earth's atmosphere are

presented. A difference method for a numerical solution is discussed. This method can be used for the limit case of chemical equilibrium, but fails under non-equilibrium conditions. The reasons for this failure are discussed and a new method for non-equilibrium states is proposed. Author (ESRO)

N69-34259# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Inst. für Aerodynamik.
HEAT TRANSFER IN LAMINAR STAGNATION FLOW TAKING INTO CONSIDERATION REAL GAS EFFECTS [DER WAERMEUEBERGANG IN DER LAMINAREN STAUPUNKTSTROEMUNG UNTER BERUECKSICHTIGUNG VON REALGAS-EFFEKTEN]
J. Steinheuer *In* WGLR Conf. Proc. of the WGLR Comm. for Aerodynamics Sep. 1968 p 172–217 refs In GERMAN (See N69-34251 19-12)
Avail: CFSTI

Because of the real gas effect in high temperature flow the following parameters appear in the boundary layer equations of a non-reactive two gas mixture: density ρ, viscosity $\rho\mu$, heat transfer parameter $\rho\mu/Pr$ and diffusion parameter $\rho\mu/Sc$. To express the independence of these parameters on enthalpy and concentration some polynomials are set up. As an example the case of a homogeneous gas is dealt with. It is shown that the heat transfer coefficient and the skin friction coefficient of the wall can be developed as exact polynomials of the wall enthalpy. Author (ESRO)

N69-34280# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Aachen (West Germany). Inst. für Theoretische Gasdynamik.
INTEGRATION PROCESS FOR THE COMPUTATION OF INCOMPRESSIBLE OSCILLATING BOUNDARY LAYERS [EIN INTEGRALVERFAHREN ZUR BERECHNUNG VON INKOMPRESSIBLEN OSZILLIERENDEN GRENZSCHICHTEN]
I. Teipel *In* WGLR Conf. Proc. of the WGLR Comm for Aerodyn. Sep. 1968 p 219–232 refs In GERMAN (See N69-34251 19-12)
Avail: CFSTI

The differential equation for an unsteady boundary layer can be transformed into an integral equation. The method is applied to oscillating boundary layer flow, using a series expansion for low frequencies. The final velocity profile is developed using some simplifying assumptions. The method is applied to flat plates. Author (ESRO)

N69-34320# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
HYPERSONIC GAS FLOW PAST A FLAT PLATE WITH A SHARP LEADING EDGE
G. M. Posdintsev 5 May 1969 16 p refs Transl. into ENGLISH from Samoletostroenie i Tekh. Vozdushnogo Flota (USSR), no. 12, 1967 p 9–15
(Contract NOw-62-0604-c)
(AD-688594; APL-CLB-3-T-585) Avail: CFSTI CSCL 20/4

The problem of hypersonic gas flow over a plane plate with a sharp leading edge is discussed. It is assumed that the gas is perfect with a constant specific heat ratio and that the plate is thermally insulated. The problem is solved theoretically on the basis of a model which makes use of the geometrical characteristics of the Navier-Stokes equations. Author (TAB)

N69-34321# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
THE INTERMITTENT REGION OF A TURBULENT BOUNDARY LAYER Interim Technical Report
Valdis Kibens and Leslie S. G. Kovasznay Jan. 1969 93 p refs
(Contract DA-31-124-ARO(D)-313)
(AD-688676; AROD-5413.3-E; ITR-1) Avail: CFSTI CSCL 20/4

The work described was part of a continuing investigation regarding the nature of the process of entrainment of non-turbulent fluid by an advancing turbulent-non-turbulent interface. The experimental results showed a distribution of flow properties in the proximity of the turbulent-non-turbulent interface. Author (TAB)

N69-34409# Royal Aircraft Establishment, Farnborough (England).
EXPERIMENTAL AND THEORETICAL STUDIES OF A TWO-SHOCK INTERACTION
J. F. W. Crane and J. G. Woodley Nov. 1968 32 p refs
(RAE-TR-68281/UL) Copyright. Avail: CFSTI

An experimental study of the flow in the region of the two shock interaction above a double wedge has been made. The tests covered free stream Mach numbers from 7 to 13 and were for wedge angles at which a reflected expension was expected from inviscid theoretical estimates. Flow visualization and pitot traverses confirmed the theoretical prediction that there was no sign of a reflected compression being induced by the influence of the viscous growth in the shear layer from the shock focus. Author

N69-34416# United Kingdom Atomic Energy Authority, Harwell (England).
TWO-PHASE TWO-COMPONENT CRITICAL FLOW IN A VENTURI
R. V. Smith, L. B. Cousins, and G. F. Hewitt Dec. 1968 54 p refs
(AERE-R-5736) Avail: CFSTI; HMSO 8s

The establishment of a functional relationship between the primary flow variables at, and just upstream of, the point of critical or choking flow for a liquid-gas mixture is discussed. The primary variables were pressure, mass flowrate, quality, and the geometry of the flow channel. Experimental and analytical work are reported for air–water flow in a converging–diverging annular venturi with critical and near-critical conditions at the throat. Measurements were made of the flowrate, thickness, and temperature of the liquid film flowing on the outer wall at the venturi. For the analytical treatment, the liquid was assumed to be made up of a film flowing on the outer wall of the venturi and of droplets entrained in the gas stream. The interrelated expressions which describe the behavior of each phase were numerically integrated from the entrance to the throat of the venturi. Good agreement was obtained between experimental and analytical results, and for two venturis with throat areas differing by a factor of 2. Discussions of critical pressure ratios, fluid velocities and interface transport processes are included. Author (NSA)

N69-34456# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
TWO-PHASE FLOW AND HEAT TRANSFER IN MULTIROD GEOMETRIES Quarterly Progress Report, 1 Jul.–30 Sep. 1968
Nov. 1968 31 p refs
(Contract AT(03-4)-189)
(GEAP-5709; QPR-12) Avail: CFSTI

Two phase flow studies were conducted and characterization data obtained for fluid flow, gas flow, and air–water flow. Fluid flow data describe the structure of adiabatic annular-dispersed two phase flow while the gas flow data characterize air flow in annular dispersed round tubes. Air–water flow data describe the flow in annuli and tubes. Velocity profiles are included in the gas flow data and entrainment fractions are determined for fluid flow and air–water flow. In addition, air–water flow characteristics were obtained from flow in low pressure horizontal channels. Measurements of film flow rate and thickness are presented along with a description of the laboratory equipment used in obtaining the measurements. D.L.G.

N69-34539# Gt. Brit. Dept. of Scientific and Industrial Research. Warren Spring Lab.
MEASUREMENT OF THE VISCOSITY OF PURELY VISCOUS NON-NEWTONIAN FLUIDS UNDER ISOTHERMAL AND STEADY SHEARING CONDITIONS
D. C.-H. Cheng Sep. 1967 101 p refs Presented at the Brit. Soc. of Rheol. Symp., Shrivenham, (Gt. Brit.), 19-21 Sep. 1967
Avail: CFSTI

The measurement of the viscosity of purely viscous non Newtonian fluids in fifteen different idealized flow situations is considered. The flows are of the Couette, Poiseuille or combined Couette and Poiseuille types and they have been chosen because the shear stress and shear rate are unambiguously defined. This paper examines the possibility of deriving explicit formulae for these quantities in terms of experimental quantities such as force and velocity measurements and dimensions of the flow channel, without assuming any specific flow curves. In practical viscometers these idealised flows are limited by several boundary effects. The paper thus also deals with the treatment of experimental data to determine and eliminate the effects of slip at channel walls, non ideal flow near the ends and edges of the flow channel and flow instability at high velocities. Although the emphasis is on viscosity measurement it will be seen that several of the flows are of industrial importance since they occur in process equipment such as pipes, channels, pumps, heat exchangers, extruders and moulders.
Author

N69-34671# California Univ., Livermore. Lawrence Radiation Lab.
EVALUATION OF EXPANSION CHAMBERS IN SHOCK TUBES
Horst P. Richter 25 Mar. 1969 7 p refs
(UCRL-50624) Avail: CFSTI

Equations for calculating flow losses in a supersonic flow are discussed and are applied to shock tube measurements. The calculations show that the flow losses are only a few percent of the kinetic energy of the gas flow when an expansion chamber is used. The flow regime of the measurements considers velocities of a few centimeters per microsecond. The stagnation pressure and temperature remain high and affect the design of efficient valves which stop the flow. Equations that may become useful in determining parameters in an equation of state for the unknown gas flow through such a tube are also given. The discussion shows that adequate measurements of pressures and flow velocities are essential for realistic calculations.
Author (NSA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-33218 National Lending Library for Science and Technology, Boston Spa (England).
THE REGULARITIES OF THE THERMAL REGIME OF THE SURFACE LAYER OF WATER
M. P. Timofeev. [1969] 14 p refs Transl. into ENGLISH from Glav. Uprav. Gidromet. Sluzh., Met. Gidr. (Leningrad), No. 2, 1967 p 57-65 in ENGLISH and partly in RUSSIAN
(NLL-M-7552-(5828.4F) Avail: Natl. Lending Library, Boston Spa, Engl.

The effects of turbulence, radiation, and heat transfer on the heat exchange between the thin surface layer of water and the atmosphere are investigated. The temperature of the surface layer is considered as being unaffected by direct solar radiation. This factor is held responsible for the existence of a negative temperature gradient at the surface of the layer. The heat balance equation is used for an approximate analysis of the thermal conditions in the thin surface layer of a water reservoir. Different methods for measuring the temperature in this layer are also discussed. The results of numerous measurements and of theoretical studies by other investigators are compared. Most of these results were obtained on bodies of water located inland, but results of ocean measurements are also cited for comparison.
K.W.

N69-33264# Naval Research Lab., Washington, D.C. Electronics Div.
UPWIND-DOWNWIND-CROSSWIND SEA-CLUTTER MEASUREMENTS Interim Report
John C. Daley, John T. Ransone, Jr., Joseph A. Burkett, and James R. Duncan Apr. 1969 19 p refs
(AD-687403; NRL-6881) Avail: CFSTI CSCL 8/3

Radar returns were collected nearly simultaneously on four frequencies-428 MHz, 1228 MHz, 4455 MHz, and 8910 MHz-for both linear and cross polarizations. In the course of these measurements, sea clutter was recorded in the upwind, downwind, and crosswind directions. The ratios of the upwind-to-downwind and upwind-to-crosswind returns were investigated as functions of the incident angle, the polarization, the radar wavelength, and the gross surface parameters of wind velocity and wave height. The upwind/downwind ratio is shown to decrease with increasing angle and surface roughness. Horizontal polarization is more sensitive to wind direction than vertical polarization. The short wavelengths are more sensitive to wind direction than the long wavelengths. The upwind/crosswind ratio remains significant at the short wavelengths for the roughest sea encountered at Puerto Rico. The results provide estimates of the upwind-downwind-crosswind relations as functions of the above parameters over an angular region of 4 to 80 degrees (vertical incidence) and from calm sea conditions to moderately rough conditions characterized by 5 - to 7-ft wave heights and 10 - to 20-knot winds.
Author (TAB)

N69-33287# Naval Oceanographic Office, Washington, D.C.
PHYSICAL BASIS AND TECHNICAL MEANS OF AERIAL METHODS
S. V. Shilin 1969 19 p refs Transl. into ENGLISH from the Russian Report
(AD-685267; NOO-TR/NS-436) Avail: CFSTI CSCL 8/2

Contents: Aerial radar methods; aerial methods utilizing the infrared band of electromagnetic waves; aerial methods utilizing ultraviolet radiation; aerial gravity reconnaissance; possibilities and prospects of joint utilization of aerial methods.
TAB

N69-33288# Naval Oceanographic Office, Washington, D.C.
PROPERTIES OF WATER DYNAMICS IN THE SOUTHEASTERN BLACK SEA AND THE DISTRIBUTION OF OCEANOGRAPHIC ELEMENTS [OBOBSHENNOSTI DINAMIKI VOD YUGOVOSTOCHOI CHASTI CHERNOGO MORYA I RASPREDELENIE OKEANOGRAFICHESKIKH ELEMENTOV]
V. A. Bibik 1969 16 p refs Transl. into ENGLISH from Tr. Azovo-Chernomorsk. Nauchn.-Issled. Inst. Morsk. Rybn. Khoz. i Okeanogr. (Moscow), no. 23, 1964 p 23-32
(AD-685259; NOO-TRANS-406) Avail: CFSTI CSCL 8/10

On the basis of the survey made in the S.E. Black Sea in August 1962, it was possible to refine the existing data on the water dynamics in this area and to add new data. This is especially applicable to the vertical water structure in the upper 500M layer of the S.E. Black Sea, where the water circulation is complex, consisting of several clockwise and counterclockwise currents. The

properties of water dynamics determined the corresponding distribution of oceanographic features in the S.E. Black Sea. The counterclockwise areas have more favorable living conditions, for phytoplankton than the clockwise areas (with regard to dynamic, chemical, and thermal situations). The greatest phytoplankton concentration in the open parts of the S.E. Black Sea was observed in the areas where the clockwise water movement interacts with the counterclockwise water movement and in the areas where the counterclockwise water movement exists. Author (TAB)

N69-33348# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jan. 1969 [OBSERVATIONS IONOSPHERIQUES ET DU RNYONNEMENT COSMIQUE] Bulletin Mensuel, Janvier 1969
1969 28 p In FRENCH and DUTCH
Avail: CFSTI

Ionospheric and cosmic ray data derived from observations made at Dourbes (Belgium) in January 1969 are given. ESRO

N69-33375*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIATION OF THE ION TEMPERATURE GRADIENT ALONG FIELD LINES IN THE OUTER PLASMASPHERE
J. M. Grebowsky and N. K. Rahman (Md. Univ., College Park) May 1969 14 p refs
(NASA-TM-X-63618; X-621-69-225) Avail: CFSTI CSCL 04A

The equations of thermal diffusion are used to explore the variation of the ion temperature in the outer plasmasphere, where H^+ is the dominant positive ion. It is shown that the ion temperature gradient component in the direction of the magnetic field is a function of only the ratio of the H^+ scale height to the He^+ scale height along the field direction when either the ion and electron temperatures are equal or the scale height ratio is unity. The ion temperature gradients are determined throughout the plasmasphere where the H^+, He^+ concentration ratio is assumed to be spatially invariant. At an altitude of 1000 kilometers in the protonosphere, the magnitude of the computed upward directed ion temperature gradient component along the field line increases from 0.9°K/Km near L = 1.3 to 1.5°K/Km at L = 5. The computed ion temperature variations are in general agreement with electron temperature observations in the topside ionosphere and the outer plasmasphere. Author

N69-33377# Army Foreign Science and Technology Center, Washington, D.C.
ANNIVERSARY SCIENTIFIC CONFERENCE OF MIGAIK AND TSNIIGAIK
L. A. Bogomolov 10 Mar. 1969 17 p refs Transl. into ENGLISH from Geodiz. i Kartograf. (Moscow), no. 1, 1968 p 73–78
(AD-687759; FSTC-HT-23-770-68) Avail: CFSTI CSCL 8/5

The translation consists of five different reports on topics related to geodesy. The first report describes the events of the joint conference of the MIIGAIK and TsNIIGAIK in honor of the 50th Anniversary of Soviet power held on 17-19 October, 1967. The second pertains to the 18-21 October, 1967 conference of NIIGAIK. The remaining three items are related to various events occurring at Soviet geodetic agencies. Author (TAB)

N69-33397# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Feb. 1969 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE Bulletin Mensuel, Fevrier 1969]
1969 28 p In FRENCH and DUTCH
Avail: CFSTI

Ionospheric and cosmic ray data derived from observations made at Dourbes (Belgium) in February 1969 are given. ESRO

N69-33400*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROMAGNETIC OBSERVATIONS IN THE SOLAR WIND
K. W. Ogilvie and L. F. Burlaga Jul. 1969 35 p refs
(NASA-TM-X-63616; X-616-69-303) Avail: CFSTI CSCL 04A

Plasma experiments on Explorer 34 were used to study the fluid properties of the solar wind. By combining the plasma data with magnetic field data from Explorer 34 a study of discontinuity surfaces has shown that (1) the magnetic field vectors are parallel to some discontinuity surfaces as required for a tangential discontinuity, (2) there are large bulk-speed discontinuities which probably indicate gliding motions at tangential discontinuities and are consistent with Sen's stability conditions, (3) there is indirect evidence for the Kelvin–Helmholtz instability at some discontinuities in the solar wind. Several propagating hydromagnetic shocks observed satisfy the Rankine–Hugoniot conditions for an isotropic, single-component fluid. A study of the causes of sudden commencements and sudden impulses showed that ssc's are nearly always caused by hydromagnetic shocks, but sudden impulses can be caused by shocks, hydromagnetic tangential discontinuities or small dense regions in the solar wind. Author

N69-33441*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME IONOSPHERIC PROPERTIES AT 1000 KILOMETERS ALTITUDE WITHIN THE AURORAL OVAL
P. L. Dyson and A. J. Zmuda (APL) Apr. 1969 47 p refs
(NASA-TM-X-63613; X-621-69-130) Avail: CFSTI CSCL 04A

Explorer 22 electrostatic probe measurements of electron density (N_e) and temperature (T_e) show that at 1000 km altitude the ionosphere within and near the auroral oval is characterized by relatively large latitudinal variations in both N_e and T_e. Electron density enhancements occur which vary from the order of ten kilometers to several hundred kilometers in horizontal extent. They vary in magnitude from increases of 10% upwards and the N_e enhancements are larger at night. Smaller scale variations (≈1 km) also occur in N_e. The degree of correlation between T_e and N_e varies because of the dynamic nature of the phenomena occurring in the oval region. Simultaneous measurements of local magnetic field fluctuations in the oval show that often the ionosphere is most irregular in the region where the magnetic disturbances occur. It is likely that the magnetic disturbances are the result of field aligned currents but the direct ionospheric effects of such currents are too small to cause the changes observed in N_e and T_e. Author

N69-33443*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH RELATED TO MEASUREMENTS OF ATOMIC SPECIES IN THE EARTH'S UPPER ATMOSPHERE
Bernard J. Wood 1 Jun. 1969 13 p refs
(Contract NASr-49(30))
(NASA-CR-103828; QSR-8) Avail: CFSTI CSCL 04A

The objective of this project is to elucidate the kinetics and mechanisms of interaction of oxygen atoms with solid surfaces of engineering interest under conditions similar to those encountered in the upper atmosphere. Such information will contribute to the quantitative interpretation of atomic-oxygen composiiton data reported by mass spectrometers in flight. Our experimental approach employs a reaction vessel in which the total gas pressure and the entering flux of oxygen atoms are held constant. The rate of

interaction of oxygen atoms with a metal surface is evaluated by observing the diminution in atom flux at the outlet of the vessel when a specimen of the material of interest is inserted into the reactor. Author

N69-33494# Danish Meteorological Inst., Charlottenlund.
OCEANOGRAPHICAL OBSERVATIONS FROM DANISH LIGHT-VESSELS AND COASTAL STATIONS, 1968 [OCEANOGRAFISKE OBSERVATIONER FRA DANSKE FYRSKIBE OG KYSTSTATIONER, 1968]
1969 177 p In DANISH and ENGLISH
Avail: CFSTI

In addition to the oceanographical observations printed in the present annual, observations of the direction, height and period of the waves together with synoptic meteorological observations are made at the light-vessels. The observations for determining the temperature and the salinity of the water are made at 08 hours at all stations. Hours are in Danish time (GMT + 1). The meaning of the figures and symbols is given; in particular it is noted that the direction of the current now is reported by the direction towards which the current is flowing. Author

N69-33555*# National Aeronautics and Space Administration, Washington, D.C.
SYNOPTIC ANALYSIS OF THE SOUTHERN HEMISPHERE STRATOSPHERE
Alvin J. Miller (Natl. Meteorol. Center, Hillcrest Heights, Md.) and Frederick G. Finger (Natl. Meteorol. Center, Hillcrest Heights, Md.) Aug. 1969 24 p refs
(NASA-TM-X-1814) Avail: CFSTI CSCL 04B

Rawinsonde data from 84 stations in the Southern Hemisphere are combined with constant-level balloon information to construct weekly hemispheric analyses for the 30-mb level for the month of June, 1967. Rocket information from Chamical, Argentina; Natal, Brazil, and Ascension Island are employed to infer the circulation at higher levels. During the period of study, the lower stratosphere of the Southern Hemisphere was dominated by a polar low with a subtropical ridge present at about 20°S. The lateral extent of the westerlies increased with height with the result that westerly winds existed in the tropical region at upper levels. Author

N69-33561# Naval Research Lab., Washington, D.C.
ELECTRON-CONTENT VARIATIONS AND CHANGE RATES OBTAINED DURING THE SPRING AND SUMMER OF 1967 BY THE MEASUREMENT OF FARADAY ROTATION OF 137-MHz RADIO WAVES TRANSMITTED FROM ATS-1 Interim Report
John M. Goodman, Melvin W. Lehman, and Edward Piemnik Mar. 1969 27 p refs
(AD-687395; NRL-6830) Avail: CFSTI CSCL 4/1

VHF radiowave transmissions (137.350 MHz) from the geostationary satellite ATS-1 (1966-110A) have been analyzed to determine the electron-content variations during the spring and summer of 1967. The regularities of the ionosphere during the observation period were found to be roughly the same as those which were observed during the Early Bird observation period of 1965. In particular it was found that there exist two extremal regions of the content-change rate function – one associated with sunrise and one associated with sunset. Irregularities in the electron content were observed to occur during both magnetically quiet and disturbed days, although extremely dramatic enhancements were recorded following two magnetic storms. Although a Chapman distribution is barely justifiable theoretically, it was found that the diurnal excursion is roughly proportional to the diurnal excursion in the square of FOF2 as predicted by simple Chapman theory. Author (TAB)

N69-33579*# Wisconsin Univ., Madison. Dept. of Meteorology.
VARIATIONS OF THE EARTH'S RADIATION BUDGET
Thomas H. Vonder Haar *In its* Meteorol. Satellite Instrumentation and Data Process. Dec. 1968 p 31–107 refs (See N69-33576 19-20)
Avail: CFSTI CSCL 04A

More than 40 months of radiometric measurements from the first generation meteorological satellites are used to describe the radiation budget of the earth–atmosphere system. The geographical and temporal variation of the energy exchange between the earth and space is examined with the aid of mean annual and seasonal maps, zonal averages, and mean global values. Maps of the radiation budget components show that the lower latitudes are characterized by radiation patterns which depart considerably from the zonal mean value. These maps mark persistent features of the atmospheric circulation during each season which should be included in numerical models that simulate atmospheric conditions. Radiation budgets of latitudinal zones, including the polar regions, are used to note areas where surface and atmospheric conditions modify the large-scale radiation budget, even though the dominant effect is due to seasonal changes in incident solar energy. On a hemispheric scale, the measurements show that, despite the difference in surface features, the northern and southern hemispheres have nearly the same radiation budget over the course of one year. Author

N69-33580*# Wisconsin Univ., Madison. Dept. of Meteorology.
THE REFLECTION OF SUNLIGHT TO SPACE AND ABSORPTION BY THE EARTH AND ATMOSPHERE OVER THE UNITED STATES DURING SPRING, 1962
K. J. Hanson, T. H. Vonder Haar, and V. E. Suomi *In its* Meteorol. Satellite Instrumentation and Data Process. Dec. 1968 p 108–124 refs Submitted for publication (See N69-33576 19-20)
Avail: CFSTI CSCL 04A

A method is described for determining the reflection of sunlight to space and absorption by the earth and atmosphere, using low resolution radiometer data from earth satellites. The method was used with Tiros 4 data together with radiation measurements at the ground to determine the reflection and absorption of sunlight over the United States during the Spring of 1962. The results indicate that for this region and time, 40% of the incident sunlight at the top of the atmosphere was reflected to space, 13% was absorbed by the atmosphere and clouds, and the remaining 47% was absorbed at the earth's surface. Atmospheric absorption of the sunlight varied from over 20% in the moist air in southeastern United States to less than 10% over much of the dry mountain west and northern plains. Atmospheric absorption values determined from this study were compared with earlier studies of absorption in a cloudless atmosphere. There is good agreement at low values of water vapor; however, the present study gave significantly higher absorption at high values of water vapor. An empirical relationship is determined for fractional absorption of sunlight as a function of optical pathlength of water vapor. Author

N69-33588*# Stanford Univ., Calif. Remote Sensing Lab.
QUANTITATIVE GEOLOGIC ANALYSIS OF MULTIBAND PHOTOGRAPHY FROM THE MONO CRATERS AREA, CALIFORNIA
Gary I. Ballew (M.S. Thesis, Mar. 1968) Feb. 1969 91 p refs
(Contract NAS9-7313; Grant NGL-05-020-115)
(NASA-CR-103891; SU-RSL-69-2) Avail: CFSTI CSCL 14B

Research was conducted to determine the effectiveness of remote sensing techniques in geologic mapping applications. This was accomplished by selecting an area of previously mapped geology and analyzing it with all remote sensing data available. The

area selected for study was the northern portion of the Mono Craters, Mono County, California, primarily because data of all the major wavelength regions were available when research for this report began in September, 1966. Specific areas of interest were field checked and samples collected in April, August and October of 1967 in attempts to correlate local geology with aircraft data, using quantitative analytical approaches. Only the multiband photographic data from the area was analyzed in great detail. Radar and infrared scanner data were also studied but not in the depth required for quantitative geologic evaluation. Author

N69-33615# Technische Hochschule Munchen (West Germany).
PETROGRAPHY, METAMORPHOSIS, AND TECTONICS OF THE KONSE SERIES IN CENTRAL TANZANIA (EAST AFRICA) [PETROGRAPHIE, METAMORPHOSE UND TEKTONIK DER KONSE-SERIE IN ZENTRAL-TANZANIA (OSTAFRIKA)]
Klaus-Dieter Meinhold (Ph.D. Thesis) 1968 24 p refs In GERMAN
Avail: CFSTI

The geochronology of Central Tanzania is studied by its petrographic, metamorphologic, and tectonic structure. Stratigraphic, magmatic, metamorphic, and tectonic successions are presented in table form. Transl. by G.G.

N69-33631*# National Aeronautics and Space Administration, Washington, D.C.
CURRENT PROGRAM AND CONSIDERATIONS OF THE FUTURE FOR EARTH RESOURCES SURVEY
H. E. Newell *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 69–75 (See N69-33626 19-14)
Avail: CFSTI CSCL 08E

The progress in satellite sensing programs is reviewed. The areas in which rapid advances have occurred are: meteorology, oceanography, forestry, agriculture, geography, hydrology, and geology. Also, the needs and future plans for these areas are discussed. It is concluded that the problems of providing a data handling and distribution network must be solved before the potentials of remote sensing can be realized. F.O.S.

N69-33636# Barringer Research, Ltd., Rexdale (Ontario).
RADIOPHASE: A NEW SYSTEM OF CONDUCTIVITY MAPPING
A. R. Barringer and J. D. Mc Neill *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 157–167 refs (See N69-33626 19-14)
Avail: CFSTI

A new system, called Radiophase, utilizes the signals from VLF radio stations to detect the presence of dipping conductive sheets in the ground, and to estimate the surface impedance of a homogeneous or horizontally stratified earth. Such signals propagate as ground waves for thousands of kilometers from the transmitter and penetrate to distances of hundreds of meters below the earth's surface. The technique measures those components of the VLF horizontal magnetic and electric fields which are in phase quadrature with the vertical electric field. Both theoretical studies and modelling have demonstrated that these quadrature components are greatly influenced by the impedance of the underlying terrain. An airborne version of the system has been flown on surveys over known mineral occurrences. Preliminary results suggest interesting correlation between the Radiophase signals and the underlying geology. Author

N69-33638# Geological Survey, Washington, D.C.
ADVANCES IN GEOGRAPHIC AND THEMATIC MAPPING APPLICATIONS OF REMOTE SENSOR DATA
Arch C. Gerlach *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 191–196 ref (See N69-33626 19-14)
Avail: CFSTI

The development of a variety of remote sensing instruments for use in aircraft and spacecraft has removed significant barriers to geographic and cartographic research, expanded tremendously the horizons for participation in the analysis and applications of new forms and great volumes of data, and stimulated a review of traditional objectives and methodologies. The hardware and instrumentation requirements for obtaining useful data from orbital heights are described in terms of current objectives, and results of research are summarized in terms of data selection, signature identification, sensor calibration, and the development of information systems and print-out techniques. The potentials and economies of international cooperation in Earth study from orbital platforms are recognized, and some of the current possibilities are mentioned. Author

N69-33665# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
OPTICAL RADAR STUDIES OF THE ATMOSPHERE
J. D. Lawrence, Jr., M. P. McCormick, S. H. Melfi, and D. P. Woodman (Coll. of William and Mary) *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 609–616 refs (See N69-33626 19-14)
Avail: CFSTI

Rigorous Mie theory calculations of clear atmosphere volume backscattering cross sections are presented for four laser wavelengths. Ruby laser radar measurements of the atmosphere are compared to a scattering model. In addition, laser radar observations of meteorological phenomena are described. Author

N69-33674# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
GAMMA-RAY MEASUREMENTS TO EVALUATE SOIL PROPERTIES
A. N. Williamson *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 737–746 refs (See N69-33626 19-14)
Avail: CFSTI

Gamma radiation from soil samples obtained from nearly all of the states and Puerto Rico was measured in the laboratory and the results were analyzed to evaluate the use of gamma-ray measurements to convey certain information about the soil. The data were arranged according to land usage, i.e. cultivated or uncultivated, and into classifications according to the following systems: geological material type, geological material age, U. S. Department of Agriculture (USDA) Great Soil Group, and USDA Soil Order based on the Seventh Approximation. By plotting the gamma-ray photopeak count ratios of Th^{232}/K^{40} versus U^{238}/K^{40} and the normalized photopeak counts for U^{238} and Th^{232} versus sand content, it was shown that the criteria for separating the soils were either too broad or not significant to the gamma-ray emissive characteristics of soil. Author

N69-33696# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPORTS IN CARTOGRAPHY AND GEODESY. SERIES 1: GERMAN CONTRIBUTIONS AND INFORMATION, NO. 37 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: DEUTSCHE BEITRAEGE UND INFORMATIONEN, HEFT NR. 37]

Herbert Kretzschmar et al 1968 60 p refs In GERMAN
Avail: CFSTI

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2. THE EXPRESSIVE FORM OF A SMALL-SCALE MAP W. Bormann p 15-31 refs (See N69-33698 19-13)

N69-33697# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

PRODUCTION OF TOPOGRAPHIC PLANS USING THE DIRECT CONTOUR ENGRAVING METHOD IN PHOTOGRAMMETRIC MEASURING APPARATUS, AND APPLICABILITY IN DEVELOPING COUNTRIES FOLLOWING EXPERIMENTAL RESULTS [DIE HERSTELLUNG TOPOGRAPHISCHER PLAENE UNTER ANWENDUNG DES DIREKTEN SCHICHTGRAVURVERFAHRENS IN PHOTOGRAMMETRISCHEN AUSMESSGERAETEN UND IHRE VERWENBARKEIT IN ENTWICKLUNGSLAENDERN NACH ERGEBNISSEN EINER VERSUCHSREIHE]

Herbert Kretzschmar *In its* Rept. in Cartography and Geodesy. Ser. 1: Ger. Contrib. and Inform., No. 37 1968 p 5-14 (See N69-33696 19-13)
Avail: CFSTI

Photogrammetric cartography by direct contact contour line engraving is described. This method is used to produce the evaluation originals for clearly interpretative copy sheets, for working sheets in field studies, as well as for immediate further processing by the contact method. Low production costs make this method attractive for topographic mapping of developing countries. Transl. by G.G.

N69-33698# Institut fuer Angewandte Geodesie, Frankfurt am Main (West Germany).

THE EXPRESSIVE FORM OF A SMALL-SCALE MAP [DIE AUSDRUCKSFORM DER KLEINMASSSTAEBIGEN KARTE]

Werner Bormann *In its* Rept. in Cartography and Geodesy. Ser. 1: Ger. Contrib. and Inform., No. 37 1968 p 15-31 refs (See N69-33698 19-13)
Avail: CFSTI

A small scale topographic map is developed from larger scaled maps by expressing geodetic as well as geological aspects through color differentiation. Scaling limitations of regional and national maps have a parallel in the network synthesis; transfers from large scale mapping to smaller scale mapping are performed in graded rectangular cutouts containing maximum visible details for later assimilation. Transl. by G.G.

N69-33764# California Inst. of Tech., Pasadena. Seismological Lab.

A THEORETICAL STUDY OF ELASTODYNAMIC RADIATION FIELDS FROM STRESS RELAXATION SOURCES. Final Report, 4 Jan. 1968 - 4 Jan. 1969

Charles B. Archambeau Apr. 1969 11 p refs
(Contract F19628-68-C-0160)
(AD-687764; AFCRL-69-0161) Avail: CFSTI CSCL 17/10

The report summarizes the work accomplished and the present status of investigations of stress wave radiation from earthquakes and explosions in prestressed media. Specifically we have treated the radiation from an explosion in a prestressed plate as a superposition of stress relaxation and shock wave conversion, using an equivalent source for the latter. The results of this theoretical work are obtainable in the form of a computer program which can be used to predict the radiation field. A summary of the results of the work accomplished indicate that a relaxation (or initial value) source model gives results which are in good agreement with observations from earthquakes and explosions in prestressed media. Author (TAB)

N69-33767 IIT Research Inst., Chicago, Ill.

ANALYSIS OF IONOSPHERIC DATA Semiannual Technical Report, 1 Oct. 1967 - 31 Mar. 1968

Robert D. Sears Jun. 1968 65 p refs
(Contract N00014-68-C-0030; ARPA Order 749)
(AD-687535; ITTRI-V6061-SA-4; SATR-4) Avail: CFSTI CSCL 4/1

The average and short term fluctuations in apparent doppler frequency imposed upon three high frequency short-hop propagation paths are described. The average variation in doppler frequency during development of the reflecting region at dawn for both geomagnetically disturbed and quiet conditions can be characterized by an exponentially decaying positive doppler signal. The small scale doppler frequency fluctuations are analyzed by power spectal analysis techniques. It is shown that the that the power spectra usually have a constant spectral intensity at high frequencies (e.g. a white spectrum), and a slightly increasing spectral intensity at lower frequencies (e.g. a pink spectrum). The power contained in the white portion of the spectrum is shown to be correlated with the geomagnetic activity index. The average changes in doppler frequency for quiet and disturbed daytime periods are related to the determination of the level of range and x-ray yield at which nuclear bursts in space may be detected against the natural background. Also, the natural fluctuation level of the hf doppler signals is related to the level of x-ray yield and range at which nuclear burst affects can be distinguished from the natural doppler noise level of an hf detection system. Author (TAB)

N69-33863# Czechoslovak Academy of Sciences, Prague.

CRYOPLANATION TERRACES, THEIR GEOGRAPHICAL DISTRIBUTION, GENESIS AND DEVELOPMENT

Jaromir Demek 1969 97 p refs *Its* Rocnik 79, Sesit 4
Avail: CFSTI

The slope terraces and summit flats that have arisen through the destructive cryogenic erosion processes are studied in the subnival climamorphogenetic region. The term cryoplanation is defined as an erosion form cutting into the bedrock, consisting of the terrace surface and a steeper rise. The development stages of cryoplanation terraces are shown as: (1) nivation hollows, (2) initial cryoplanation terraces, (3) mature terraces, and (4) final topographic surface. Pictures of typical cryoplanation flats are included. F.O.S.

N69-33878# Institut Royal Meteorologique de Belgique, Brussels. Instituut d'Hygiene et d'Epidemiologie.

ATMOSPHERIC POLLUTION, SMOKE AND SULFUR DIOXIDE Monthly Bulletin, Oct. 1968 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX]

1968 21 p In FRENCH and DUTCH
Avail: CFSTI

Tables are given on sulfur dioxide and smoke quantity (air pollution) measured in different weather stations in Belgium in October 1968. A brief description is given of the air sample apparatus. ESRO

N69-33895# Commissariat à l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucléaires.
SOIL CONTAMINATION. PART 1: CHANGES IN THE HUMIDITY OF NON-SATURATED SOILS AFTER REJECTIONS IN A LIMITED SPACE [CONTAMINATION DES SOLS. PREMIERE PARTIE: EVOLUTION DE L'HUMIDITE DANS LES SOLS NON SATURES APRES REJETS SUR UNE SURFACE LIMITEE]
Daniel Rancon Feb. 1969 53 p refs In FRENCH; ENGLISH summary
(CEA-R-3635-1) Avail: CFSTI

An important feature in radiological safety studies of sites are the water movements in the unsaturated layer surmounting the aquifer; this zone of aerated soil can be effective as a protection against aquifer contamination. Utilizing a neutron-moisture meter, a method was developed to build graphically the hydrological states of the soil and the moistened volume evolution with time in the particular case of a limited feeding surface. It is also possible to measure moisture gradients, drying kinetics, the retention capacity of soil and the gravific water content achieved by a given water head. The initial hydrological state only has an effect on the infiltration rate and does not affect the moistened front position or the volume of moistened soil; consequently, the storable water amount in the soil can be calculated. When water feeding has been stopped, the volume of moistened soil increases to an equilibrium state restricted by the moistened front and all the other water movements occur exclusively inside this volume. Consequently in case of radioactive waste disposal, the ionic pollution will be confined inside a measurable volume, the moistened front being the maximum limits of this volume. Author (ESRO)

N69-33921# Bureau of Meteorology, Melbourne (Australia).
THE LAVERTON SERIAL SOUNDING EXPERIMENT
Dec. 1968 108 p refs
Avail: CFSTI

This series of sounding over a one-month period during Sept./Oct. 1968 was conducted to obtain data on wind, temperature, and humidity from the ground to an altitude of 25 km every three hours, and of ozone once daily. In addition, ozone observations were made from a synoptic network of four stations at selected times prior to, during, and after the passage of a depression or trough of low pressure and associated cold front from west to east across the network. The data were obtained in order to examine mesoscale phenomena in the troposphere and lower stratosphere in relation to their synoptic background. Measurements were made by radiosonde, ozone sonde, balloons, and a new wind-finding radar system. The instrumentation and methods of data acquisition, reduction, and accuracy are described. Wind, temperature, and ozone profiles are presented, and synoptic charts are included of the surface, 500 mb, and 200 mb levels for each day of the period. K.W.

N69-33928# Institut Royal Météorologique de Belgique, Brussels. Inst. d'Hygiène et d'Epidémiologie.
ATMOSPHERIC POLLUTION, SMOKE AND SULFUR DIOXIDE Monthly Bulletin, Aug. 1968 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX]
1968 18 p In FRENCH and DUTCH
Avail: CFSTI

Tables are given on sulfur dioxide and smoke quantity (air pollution) measured in different weather stations in Belgium in August 1968. A brief description is given of the air sample apparatus. ESRO

N69-33933# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
GEOLOGY AND MINERAL DEPOSITS, PORT MORESBY/KEMP WELCH AREA, PAPUA
K. R. Yates and R. Z. de Ferranti 1967 206 p refs
(PNG-1; Rept-105) Avail: CFSTI

The results of a geological and geochemical investigation of the Astrolabe mineral field, Papua, are reported. The following program was completed: (1) mapping of the Astrolabe mineral field at a scale of 400 feet to 1 inch, and collection of geochemical samples from streams draining the area; and (2) mapping of the Geboria, Tupuselela, Gaile, and Gea 1:50,000 sheet areas, and collection of geochemical samples from streams draining the areas. Geochemical samples collected from stream sediments averaged 10 samples per square mile. In addition, magnetite concentrates were collected, and rocks and gossans were sampled. All the samples were analysed for copper, zinc, nickel, and cobalt. Two anomalous areas showing significantly high total copper values were found in the Astrolabe mineral field. An area of 20 square miles of combined moderately high copper and zinc values near the Kemp Welch River is thought to be related to slight composition changes in the Sadowa Gabbro. Author

N69-33945# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPORTS IN CARTOGRAPHY AND GEODESY. SERIES 1: GERMAN CONTRIBUTIONS AND INFORMATION, NO. 34 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: DEUTSCHE BEITRAEGE UND INFORMATIONEN, HEFT NR. 34]
1967 105 p refs In GERMAN
Avail: CFSTI

CONTENTS:

1. TASKS AND RESULTS OF THE ICAO MAP CONFERENCE, 1966 H. Knorr p 5–24 refs (See N69-33946 19-13)

2. THE VACUUM FORMING OF PLASTIC FILMS FOR RELIEF MAPS H. Muehle p 25–45 refs (See N69-33947 19-13)

3. MASKING OF MAP ELEMENTS FOLLOWING ENGRAVING H. G. Lay p 47–50 refs (See N69-33948 19-13)

4. APPLICATION POSSIBILITIES OF DENSITOMETRY IN THE PRODUCTION OF MULTICOLOR MAPS F. Christ p 51–90 refs (See N69-33949 19-13)

5. POSSIBILITIES FOR MARKING THE OPTICAL APPEARANCE OF PRINTED COLORS BY NUMERICALLY CODED COLOR SYSTEMS OR BY STANDARDIZED COLOR MEASUREMENT VALUES H. Uhrig p 91–99 refs (See N69-33950 19-15)

N69-33946# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TASKS AND RESULTS OF THE ICAO MAP CONFERENCE, 1966 [AUFGABEN UND ERGEBNISSE DER ICAO-KARTENKONFERENZ 1966]
Herbert Knorr *In its* Rept. in Cartography and Geodesy, Ser. 1: Ger. Contrib. and Inform., No. 34 1967 p 5–24 refs (See N69-33945 19-13)
Avail: CFSTI

Six points examined in the joint sessions of the group on Aeronautical Information Services and Maps (AIS/Maps) during the International Civil Aeronautics Organization (ICAO) conference are reported. These six points are concerned with the following: (1) general mapping guidelines, including color control, definition of significant flight obstacles, relief, and control of map signatures; (2) sheet coordination for the World Aeronautical Chart ICAO 1 : 1,000,000; (3) guidelines for developing air navigation charts 1 : 2,000,000 and smaller; (4) control and coordination of aeronautical chart production; (5) necessity for an ICAO map handbook and extension of the AIS handbook; and (6) review of cartographic guidelines. Corrections and recommendations for existing aeronautical charts are also presented. Transl. by K.W.

N69-33947# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE VACUUM FORMING OF PLASTIC FILMS FOR RELIEF MAPS [DIE VAKUMVERFORMUNG VON KUNSTSTOFF-FOLIEN ZU KARTENRELIEFS]
Helmut Muehle *In its* Rept. in Cartography and Geodesy. Ser. 1: Ger. Contrib. and Inform., No. 34 1967 p 25–45 refs (See N69-33945 19-13)
Avail: CFSTI

Material properties and fabrication methods are discussed for forming in the hard-elastic range, where softening occurs around 70° to 80°C; the thermoelastic range of 80° to 130°C up to the flow point around 160° to 180°C; and the thermoplastic range, above 170°C. Vacuum deep drawing, mechanical, and pneumatic stretch forming are briefly described. Vacuum control and heating methods and durations for PVC emulsions, suspensions, mixed polymers, and polystyrene are examined. The machines and costs involved in relief production are considered.
Transl. by K.W.

N69-33948# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
MASKING OF MAP ELEMENTS FOLLOWING ENGRAVING [MASKIERUNG VON KARTENELEMENTEN NACH DER GRAVUR]
Hans Guenter Lay *In its* Rept. in Cartography and Geodesy. Ser. 1: Ger. Contrib. and Inform., No. 34 1967 p 47–50 refs (See N69-33945 19-13)
Avail: CFSTI

A method for masking the engraved elements on an engraving film was tested. A tinted ammonium bichromate colloid layer on the working surface of the film is hardened by exposure to an open arc lamp. This is followed by removal of the unhardened parts of the colloid layer by means of a water bath and by immersion in the coloring bath. The steps of the process, the solutions, and the pigments are listed.
Transl. by K.W.

N69-33949# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
APPLICATION POSSIBILITIES OF DENSITOMETRY IN THE PRODUCTION OF MULTICOLOR MAPS [ANWENDUNGSMOEGLICHKEITEN DER DENSITOMETRIE BEI DER HERSTELLUNG MEHRFARBIGER KARTEN]
Fred Christ *In its* Rept. in Cartography and Geodesy. Ser. 1: Ger. Contrib. and Inform., No. 34 1967 p 51–90 refs (See N69-33945 19-13)
Avail: CFSTI

Theoretical principles, measuring methods, and available densitometers are reviewed. The application possibilities in cartography are discussed based on the experiences gained in the production of map originals, copies, and prints. Color densitometry is stressed. Applications for controlling the density of screens, halftones, and hachures are discussed in addition to the control of full colors on negatives, films, proofs, and production maps.
Transl. by K.W.

N69-33979# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A LARGE-POPULATION LASA DISCRIMINATION EXPERIMENTATION
Richard T. Lacoss 8 Apr. 1969 76 p refs
(Contract AF 19(628)-5167; ARPA Order 512)
(AD-687478; ESD-TR-69-69; TN-1969-24) Avail: CFSTI CSCL 17/10

Short-period data from the Large Aperture Seismic Array (LASA) has been used in the past to develop and evaluate single station seismic discriminants for events at teleseismic distances from the array. The long-period data from LASA has been used in conjunction with the short period data to evaluate the ability of a single station to identify events based upon the relative excitation of body phases and surface phases. The present report is devoted primarily to further studies of single station discriminants which have been measured for a large population of almost 200 events.
Author (TAB)

N69-34018# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS [OBSERVATIONS GEOPHYSIQUES] Monthly Bulletin, Jan. 1969
1969 36 p In FRENCH and DUTCH
Avail: CFSTI

Data are given from the geophysical observatories in Belgium related to: geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity and cosmic rays for January 1969.
ESRO

N69-34028# Army Foreign Science and Technology Center, Arlington, Va.
USE OF ELECTRONIC COMPUTERS IN TOPOGRAPHIC AND GEODETIC WORK
L. A. Kashin Mar. 1969 15 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 5, 1968 p 13–19
(AD-687427; FSTC-HT-23-713-68) Avail: CFSTI CSCL 8/2

Different enterprises of the main administration of geodesy and cartography are using electronic computers to different degrees. As a result of the broader use of electronic computers the main objectives are as follows: perform scientific research work on problems involved in the radical restructuring of the organization of all geodetic computations using electronic computers ranging from the collection, transmission and input of data into the electronic computer to the printout of catalogues and storage of the results of computations for subsequent work; begin using electronic computers, punch-card machines and tabulators for economic computations and production control; broaden the use of analytical methods of phototriangulation in topographic work; and form a library of the best programs for all existing types of electronic computers and for all types of problems.
TAB

N69-34037# Weapons Research Establishment, Salisbury (Australia).
OZONE MEASURING TECHNIQUES AND THEIR ASSESSMENT FOR WRE DROPSONDE USE
N. V. Siesons Dec. 1968 22 p refs
(WRE-TN-SAD-196) Avail: CFSTI

Methods of measuring atmospheric ozone are assessed in regard to their application to the Weapons Research Establishment dropsonde system. It has been concluded that an optical method could be incorporated into the existing dropsonde system to measure ozone densities between 60km and 30km and this is discussed in some detail.
Author

N69-34062# Aeronautical Chart and Information Center, St. Louis, Mo.
JOHNSTON ISLAND PRELIMINARY SATELLITE NETWORK COORDINATES
Donovan N. Huber Feb. 1969 22 p refs
(AD-687478; ACIC-TR-113) Avail: CFSTI CSCL 8/8

Worldwide Geometric Satellite Network Coordinates were derived for Johnston Island from a combination of BC-4 and PC-1000 stellar camera data. Simultaneous observations were made between the USC and GS BC-4 cameras on Maui, Wake, and Christmas Islands and an Air Force PC-1000 camera on Johnston Island. The PAGEOS, ECHO I and ECHO II satellites were observed. Initial data and results of the major phases of data reduction are

presented and are discussed in tabular and graphic form. The circular standard error achieved in the positioning of Johnston Island relative to the three World Net stations was less than 10 feet, or better than one part in 750,000. Author (TAB)

N69-34087# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany). Institut für Geophysik und Meteorologie.
CURRENT SYSTEM AND MAGNETIC FIELD OF THE EQUATORIAL ELECTROJET [DER AEQUATORIALE ELEKTROJET: STROMSYSTEM UND MAGNETFELD]
J. Untiedt Jun. 1968 102 p refs In GERMAN *Its* GAMMA, v. 2, 1968 p 1–81
Avail: CFSTI

A theoretical model of the equatorial electrojet including meridional currents is derived and solved numerically. The model is compared with observational data derived from ground-based, rocket, and radar measurements. Also, data on the magnetic field strength caused by the electrojet are compared with the model and the dependence of the electrojet on large-scale ionospheric winds or on a primary electric field directed north-south is discussed. ESRO

N69-34094# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME 8, NO. 2 Second Quarter, 1968
Anne L. Carrigan, ed. and Norman J. Oliver, ed. 1968 281 p refs
(AD-675951) Avail: CFSTI CSCL 4/1

CONTENTS:

1. TOTAL FIELD INTENSITY MAGNETOMETER p 3–11 (See N69-34095 19-13)
2. COSMIC RAY NEUTRON INTENSITY MONITOR p 13–25 (See N69-34096 19-13)
3. EXTREMELY LOW FREQUENCY NOISE p 27–29 (See N69-34097 19-13)
4. SOLAR OPTICAL PATROL OBSERVATIONS p 33–84 (See N69-34098 19-30)
5. SOLAR RADIO EMISSION p 85–165 ref (See N69-34099 19-30)
6. VERTICAL INCIDENCE IONOSPHERIC SOUNDINGS p 167–240 (See N69-34100 19-13)

N69-34095# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
TOTAL FIELD INTENSITY MAGNETOMETER
In its Geophys. and Space Data Bull., vol. 5, no. 2 1968 p 3–11 (See N69-34094 19-13)
Avail: CFSTI

Data tables are presented for the horizontal and total field intensity measured in the months of April, May, and June 1968 with the Total Field Intensity Magnetometer. Hourly measurements are given, along with mean deviations and power spectra of the deviations, for the month. M.W.H.

N69-34096# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
COSMIC RAY NEUTRON INTENSITY MONITOR
In its Geophys. and Space Data Bull., Vol. 5, No. 2 1968 p 13–25 (See N69-34094 19-13)
Avail: CFSTI

Hourly data are presented for the Cosmic Ray Neutron Intensity Monitor Network pressure variation measurements during April, May, and June 1968. Geographic positions of the various stations are given, and mean values are shown for each day. M.W.H.

N69-34097# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
EXTREMELY LOW FREQUENCY NOISE
In its Geophys. and Space Data Bull., Vol. 5, No. 2 1968 p 27–29 (See N69-34094 19-13)
Avail: CFSTI

Extremely low frequency noise was measured in April, May, and June 1968. Daily graphs of the data are presented for April 26 through June 30. M.W.H.

N69-34100# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
VERTICAL INCIDENCE IONOSPHERIC SOUNDINGS
In its Geophys. and Space Data Bull., vol. 5, no. 2 1968 p 167–240 (See N69-34094 19-13)
Avail: CFSTI

Tables are presented for vertical incidence ionospheric soundings. The data include daily values for absorption loss, median values and curves for several ionospheric characteristics, and hourly values for the same characteristics from Dec. 1967 through April 1968. M.W.H.

N69-34305# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
MATHEMATICAL MODEL STUDY OF THE PROPAGATION OF TIDES IN THE ST. LAWRENCE RIVER AND ESTUARY
J. W. Kamphuis Aug. 1968 72 p refs
(AD-685376; DME-MH-105; NRC-10541) Avail: CFSTI CSCL 8/8

In this report a mathematical study of the tidal motion in the St. Lawrence river and estuary is presented. Three different types of finite-difference models are discussed in detail, one explicit scheme and two implicit schemes. The differential equations are derived and methods of schematization are discussed. Subsequently, for each of the models the finite-difference equations, the methods of solution, stability, convergence, and final results are given and the models are compared as to their relative advantages and usefulness. Author (TAB)

N69-34343# Lamont Geological Observatory, Palisades, N.Y.
SONIC PROPERTIES OF DEEP SEA CORES FROM THE NORTH PACIFIC BASIN AND THEIR BEARING ON THE ACOUSTIC PROVINCES OF THE NORTH PACIFIC Technical Report
David R. Horn, Barbara M. Horn, and Marilyn N. Delach Dec. 1968 442 p refs
(Contract N00024-67-C-1188)
(AD-685250; TR-10; CU-10-68) Avail: CFSTI CSCL 8/7

Two hundred and fifty long piston cores of deep-sea sediments from the North Pacific have been analyzed and predictions of their acoustic properties are given. Maps are included that outline submarine physiography, and the regional distribution of turbidites, volcanic ashes and sub-bottom reflecting horizons. Tentative statements are made about the reflectivity of the floor of the North Pacific based solely on a survey of bottom materials. Reliable reflectors occur within a broad zone at the periphery of the North Pacific basin. They extend 800 miles seaward of Japan, 600 miles southeast of the Kamchatka Peninsula, 400 miles south of the Aleutian Islands, and 1100 miles due west of Oregon. A narrow

zone of sub-bottom reflectors (turbidites) surrounds the Hawaiian ridge. It is at least 80 to 135 miles wide on each side of the ridge. Author (TAB)

N69-34344# Naval Oceanographic Office, Washington, D.C.
VERTICAL STRUCTURE OF WATER AND GENERAL FEATURES OF WATER CIRCULATION IN THE BLACK SEA [VERTIKALNO STOENIE VODNOI TOLSHCHI I OBSHCHIE CHERTY TSIRKULYATSII VOD CHERNOGO MORYA]
V. P. Novitskii 1968 28 p refs Transl. into ENGLISH from Azovsko-Chernomorsk. Nauchn.-Issled. Inst. Morsk. Rybn. Kohz. i Oceanogr. Tr. (USSR), no. 23, 1964 p 3–22
(AD-685258; TRANS-405) Avail: CFSTI CSCL 8/3

The basic regularities of spatial distribution of temperature and salinity of the trophic layer are determined by hydrometeorological factors and by dynamic causes. The distribution of these elements in the deep and bottom water is induced mainly by dynamic causes. The Black Sea is characterized by deep mixing, involving the entire water column from surface to bottom. The intensity of the vertical mixing is determined by the intensity and character of atmospheric circulation over the sea, by the frequency of convergence-divergence phenomena, by internal waves, and by the amount of inflowing sea of marmara water and continental runoff. The status of the biogenic and food base for fishes of the trophic layer depends not only upon the amount of the continental runoff, but also upon the intensity of vertical mixing, which takes place throughout the sea. It is realized that surface water is enriched with biogenic elements brought into the trophic layer from depths in counterclockwise current systems, by upwelling taking place on the continental shelf, and by the introduction of biogenic elements into the coastal vertical circulation, owing to internal wave and convergence-divergence phenomena. Author (TAB)

N69-34369# Michigan Univ., Ann Arbor. VELA Seismological Center.
HANDBOOK ON EARTHQUAKE MAGNITUDE DETERMINATIONS
Markus Bath, comp. (Seismological Inst., Uppsala, Swed.) May 1969 183 p refs Revised
(Contract DA-49-083-OSA-3137; ARPA Order 175)
(AD-687977; VESIAC-7885-36-X) Avail: CFSTI CSCL 8/11

The first edition of this book was finished in August, 1967, as a preparation for the Zurich Assembly in 1967 of IUGG. The second edition of the magnitude handbook has undergone a number of revisions compared to the first edition. These revisions can be summarized in the following points: Replies to our questionnaire; Under the heading Miscellaneous Contributions we have added some magnitude comparisons; A new section including titles and abstracts of all magnitude papers scheduled for the Zurich Assembly 1967 has been given. Author (TAB)

N69-34382# Army Electronics Command, Fort Monmouth, N.J.
ATMOSPHERIC ELECTRIC PROPERTIES
Willim C. Barr Apr. 1969 37 p refs
(AD-688587; ECOM-3117) Avail: CFSTI CSCL 4/1

A semi-empirical model of atmospheric electric properties has been constructed. This was accomplished by combining mathematical expressions of the applicable electrical laws with an empirical formula for conductivity as a function of altitude. In this way, an internally consistent model was obtained. The calculated numerical values are well within the range currently accepted by workers in the field. Author (TAB)

N69-34383# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
FARADAY ROTATION SYSTEM FOR MEASURING ELECTRON DENSITIES
Roberto Rubio Mar. 1969 33 p refs
(AD-688514; ECOM-5243) Avail: CFSTI CSCL 4/1

The Faraday rotation radio propagation experiment for measuring electron densities in the 80-90 km region of the ionosphere is described in this report. After a brief introduction of the Faraday rotation theory, its applicability at 32 degrees N latitude (WSMR) is explained. The experimental procedure that is followed, the ground transmitting equipment, rocket payload and receiving instrumentation are also described. Author (TAB)

N69-34386# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
OZONE MEASUREMENTS FROM A STABLE PLATFORM NEAR THE STRATOPAUSE LEVEL
Jagir S. Randhawa Mar. 1969 22 p refs
(AD-688513; ECOM-5242) Avail: CFSTI CSCL 4/1

The rocket-borne ozonesonde developed at the Atmospheric Sciences Laboratory, White Sands Missile Range, New Mexico, was modified and launched on a 28 million cubic foot balloon, along with other sensors, at sunrise on 11 September 1968. The data received as the balloon floated near the stratopause level show a concentration of ozone which is one order of magnitude more than the concentration of ozone which has been measured by spectrometric methods. The marked increase in the ozone concentration observed immediately after sunset at the 40 km level is of great significance to an understanding of the photochemistry of ozone. Author (TAB)

N69-34431# Woods Hole Oceanographic Institution, Mass.
GRAVITY DATA OBTAINED DURING CHAIN CRUISE NO. 70
Carl Bowin and Thomas Aldrich Feb. 1969 54 p refs
(Contract Nonr-4029(00); Grant NSF GA-276)
(AD-687683; WHOI-Ref-69-8) Avail: CFSTI CSCL 8/14

Profiles, tabulations, and charts are presented of principal gravity facts, free-air gravity anomalies, and simple Bouguer gravity anomalies obtained in the western North Atlantic Ocean during R/V CHAIN cruise 70. Author (TAB)

N69-34550# Army Foreign Science and Technology Center, Washington, D.C.
ON THE POSSIBILITY OF USING THE DATA OF RADIOSOUNDING TO INVESTIGATE THE BOUNDARY OF THE ATMOSPHERE
M. S. Akhmetov Apr. 1969 16 p refs Transl. into ENGLISH from Tr. Gl Geofiz. Observ. (Leningrad), no. 206, 1967 p 134–142
(AD-687504; FSTC-HT-23-883-68) Avail: CFSTI CSCL 4/1

The results of comparing the readings of the A-22-IV radiosonde with the readings of aerostat and helicopter meteorographs, the A-56 surface radiosonde and with data of pilot balloon observations are considered. The change of vertical velocity of the A-22-IV radiosonde in the lower 1.5-kilometer layer of the atmosphere is investigated. Author (TAB)

N69-34874# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
PROPERTIES OF QUARTZES AND FELDSPARS FROM PEGMATITES (TICINO, SWITZERLAND). PART A: IMPURITIES IN QUARTZES AND FELDSPARS. PART B: OPTICAL, CHEMICAL AND X-RAY PROPERTIES OF FELDSPARS (ALKALI FELDSPARS AND PERISTERITES)
Krishnamoorthy Viswanathan (Ph.D. Thesis) 1968 66 p refs
Its Diss. No. 4063
Avail: CFSTI

Geochemical and mineralogical analyses were conducted. Quartzes and feldspars were isolated from 60 samples of pegmatites and pegmatoid schlieren collected in this area. Emission-spectrochemical analyses were made to determine the trace elements Al and Li in the quartzes and the Li in the feldspars. The potassium feldspars and the plagioclases were examined by chemical microprobe, single-crystal photography, and X-ray powder photography. The plagioclases with peristerite composition showed different degrees of exsolution, and the analysis of the composition of their phases required intensive studies. Transl. by K.W.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-33322*# National Aeronautics and Space Administration, Washington, D.C.
EVALUATION OF MOTION-DEGRADED IMAGES
1969 178 p refs Presented at a seminar, Cambridge, Mass., 3–5 Dec. 1968
(NASA-SP-193) Avail: SOD $2.00; CFSTI CSCL 14E

Primarily discussed is the state-of-the-art and the progress made in the development of techniques for the removal of motion degradations from photographic imagery. Emphasis is placed on degradations induced by atmospheric turbulence. For individual titles, see N69-33322 through N69-33345.

N69-33323*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THE PRECISION OF EDGE ANALYSIS APPLIED TO THE EVALUATION OF MOTION-DEGRADED IMAGES
Melvin J. Mazurowski and Robert E. Kinzly *In* NASA Evaluation of Motion-Degraded Images 1969 p 111B refs Sponsored by NASA (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

In the process of evaluating the quality of the Lunar Orbiter photography, the precision of the edge analysis techniques in evaluating the system modulation transfer function was studied in detail. These results are used to determine the probability that motion degradations can be evaluated as a function of the number of edge traces used in the analysis and the magnitude of the motion degradation. In addition, edge gradient techniques were used to assess the image motion compensation capability of the Lunar Orbiter photographic system in actual operation and preflight laboratory testing. An oblique high resolution photograph, taken during the Lunar Orbiter II mission, can be expected to exhibit different degrees of compensation with format position. Eleven areas in the format of the photograph were selected, appropriate edges scanned, and values of the resolution at the lunar surface determined. The resolutions compared favorably with those values expected for each of the areas in the format depending upon the distance of each area from the point at which the IMC detector was aimed. Alaboratory test of the operation of the IMC system for the primary and backup photo subsystems for the Orbiter V mission was made. Edge gradient analysis made on the recorded edges of the checkerboard pattern clearly shows the motion-degrading effects between images obtained with the IMC operating and with it off. Author

N69-33324*# National Aeronautics and Space Administration, Electronics Research Center, Cambridge, Mass.
ON THE DENSITOMETRIC STRUCTURE OF MOTION-BLURRED EDGE TRACES IN UNDEREXPOSED PHOTOGRAPHS AND ITS EFFECT ON IMAGE-ANALYSIS PROCEDURE
Max R. Nagel *In its* Evaluation of Motion-Degraded Images 1969 p 19–33 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

This paper concerns photographic anomalies, which can be observed within the image traces contained in a heavily motion-degraded photograph, that are caused by the photometric structure of the projected image, the sensitometric properties of the photographic material, and, in some cases, by the photographic apparatus. In particular, the case of underexposure is considered. The results of laboratory experiments on the subject will be shown and discussed. It appears that the amount of blur present in the underexposed photograph of an object depends on the luminance of the object and its background and that it can be influenced by the developing process. Images of the same object can produce different amounts of blur depending on their location in the image plane and on the mechanical characteristics of the shutter used. The amount of motion blur in the forward edge of an image can be different from that in the aft edge. In general, the distribution of the density within the image trace is subject to a modified version of reciprocity law failure. Author

N69-33325*# Rome Air Development Center, Griffiss AFB, N.Y.
EFFECT OF IMAGE RESOLUTION AND CONTRAST ON TARGET DETECTION AND IDENTIFICATION
Sheldon MacLeod and John J. Maier *In* NASA Evaluation of Motion-Degraded Images 1969 p 35–41 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

The amount of useful intelligence extracted from aerial photography by image interpreters is dependent upon many factors. One of these is obviously the quality of the imagery he is viewing. A number of behavioral studies have been performed to evaluate this type of relationship; i.e., the dependency of measures of interpreter performance upon image contrast, sharpness, resolution or granularity. The objective of this study was to explore the joint effects of two of these indices, resolution and contrast, upon four types of interpreter performance measures. The selection of resolution as an experimental factor alines this study with the theme of the present conference, since along with aberration and focus of the camera's lens system and the type of film selected, uncontrolled image motion is a principal operational determinant of photographic resolution. Author

N69-33326*# Perkin-Elmer Corp., Norwalk, Conn.
PREDICTION AND COMPENSATION OF LINEAR IMAGE MOTIONS IN AERIAL CAMERAS
Earle B. Brown *In* NASA Evaluation of Motion-Degraded Images 1969 p 45–51 ref (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14B

Image motions in aerial cameras of any type arise from two causes: apparent ground motion and camera rotation. General equations are given for each variety of motion for a camera pointed in any direction, including the differential motions resulting from errors in pointing. The five image motion patterns which can appear in the focal plane are named and described and the conditions for their occurrence are identified. Tables of the coefficients for ground motion in the fight direction for the sixteen possible pointing sequences around three orthogonal vehicle axes have been given in a publisher paper. Author

N69-33327*# Bolsey Associates, Inc., Glenbrook, Conn.
USE OF ELECTRO-OPTICAL IMAGE CORRELATION FOR MEASURING AND PROVIDING COMPENSATION FOR IMAGE MOTION
Norman G. Altman *In* NASA Evaluation of Motion-Degraded Images 1969 p 53–65 (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14B

The V/H sensor developed for the NASA Lunar Orbiter photographic missions weighed 10 pounds, required 8-1/2 watts, and held image smear on the processed film itself to less than 2-1/2 microns. This means that the residual image motion at the image plane of the sensor was less than 1-1/2 microns. This V/H sensor used an electromechanical area scanner and an electronic correlator operating with an electromechanical closed-loop servosystem. Second generation, all-electronic scanner-correlators have been developed that weigh 5 pounds, require 5 watts, and are capable of maintaining image stability to within ±1 micron over very large dynamic ranges. These systems operate with zero image motions as well as with V/H rates out to 10 radians per second. This paper delineates some of the system considerations associated with reducing image smear and describes the operation of first and second generation V/H sensors. Also described is an extension of the basic system that can be used to measure the belt velocity of V/H sensor test sets to fractional micron (5 to 10 microinch) accuracy. Author

N69-33328*# Itek Corp., Lexington, Mass.
V/H SENSOR THEORY AND PERFORMANCE
Richard J. Jones *In* NASA Evaluation of Motion-Degraded Images 1969 p 67?2 (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14B

High resolution aerial photography requires the precise determination of aircraft angular motion over the earth (V/h). As aerial reconnaissance precision increases, greater precision is required of motion sensing and compensation equipment. Conventional V/h sensors employ photomultiplier-grid scanners, navigational devices, and other moderate performance techniques. More complex high performance devices employing image correlation techniques are under development. The scheme to be discussed here examines the power spectrum of an imaging system and shows substantial improvement over conventional methods. The technique makes use of a vidicon camera. The detected output level of the integrated scene-related electrical spectrum from the vidicon is a measure of drift of the scene on the vidicon target. This output is a true autocorrelation function of the scene in the time domain with the integration time of the target of the vidicon as a parameter. Author

N69-33329*# Naval Observatory, Washington, D.C.
SEEING AS CONSIDERED BY ASTRONOMERS
Alfred H. Mikesell *In* NASA Evaluation of Motion-Degraded Images 1969 p 75–81 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14B

Despite average seeing motions or image dispersions on the order of at least 2 seconds of arc, the astronomer obtains astrometric precisions as great as 0.002 second of arc, at the cost of large bodies of data. Even such observing redundancy rarely if ever provides a view of image detail comparable to the diffraction limit of the equipment. Analog or digital procedures of deconvolution, based upon star images formed by the same telescope objective during the same viewing interval, might free data from seeing restrictions. A surprisingly large expenditure for new, easily-used equipment or procedures to provide such freedom is justified by the present cost of redundant data taking, digital deconvolution, and remote telescope sites (especially those outside the atmosphere). It is noted that some presently constructed telescopes not only are large enough to serve developmental routines, but also are fixed, using coelostats, as do laboratory devices. Author

N69-33331*# Stanford Univ., Calif.
USE OF A LARGE-APERTURE OPTICAL SYSTEM AS A TRIPLE INTERFEROMETER FOR REMOVAL OF ATMOSPHERIC IMAGE DEGRADATIONS
Joseph W. Goodman *In* NASA Evaluation of Motion-Degraded Images 1969 p 89–93 refs Sponsored by ONR (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14B

A new method for image restoration is discussed, based on an interferometric technique. This method is accomplished by inserting a movable mask in the optical system to remove the redundancy normally present, and by inserting a beam-splitting arrangement which allows the formation of three separate images. By properly combining the phases of various spatial frequency components of the three images, a composite image with the correct phases may be constructed. No information concerning the point spread function of the atmosphere is required. The chief difficulties associated with this technique are (1) its extremely low detection sensitivity, due to the fact that redundancy has been eliminated, (2) the requirement that the object be motionless while the images are recorded, and (3) the requirement that the object lie within a single isoplanatic region of the atmospheric inhomogeneities. Author

N69-33333*# Conductron Corp., Ann Arbor, Mich.
OPTICAL RESTORATION USING OPTIMUM FILTER THEORY OF IMAGES BLURRED BY ATMOSPHERIC TURBULENCE
Joseph L. Horner *In* NASA Evaluation of Motion-Degraded Images 1969 p 105–111 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

By manipulation of the Fourier spectrum of a degraded optical image recorded on photographic film, it is possible to reduce the effects of out-of-focus lenses, lens aberrations, linear motion, and atmospheric turbulence. In addition to the simple inverse filter, which is proportional to the reciprocal Fourier transform of the system point spread function (PSF), the use of an optimum least means square (LMS) filter has been successfully demonstrated, experimentally, for images degraded by long-term atmospheric turbulence. The PSF due to the turbulence was measured, and used in designing the optimum filter, as was the signal-to-noise ratio of the recording film. Smear length of twice the minimum resolution length in the object scene were successfully restored. The superiority of the optimum LMS filter over the inverse filter is shown conclusively. The restoration is performed on a coherent optical analog computer, using the Fourier transform property of a lens. The enhancement may be accessed quantitatively from the modulation transfer function (MTF) of the restored image. Experimental curves of the MTF are presented. An enhancement of four times is obtained in the mid-frequency range of spatial frequencies. Author

N69-33334*# Florida Univ., Gainesville.
PHOTOELECTRONIC RESTORING SYSTEM FOR IMAGES DEGRADED BY ATMOSPHERIC TURBULENCE
Werner H. Bloss, Gunter H. Lohnert, and Richard T. Schneider *In* NASA Evaluation of Motion-Degraded Images 1969 p 113–118 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

An electronic image restoration process is described based on an image orthicon detection system and an analog processing system. Conventional components of TV equipment and of analog computers have been used in the procedure. A laboratory experiment has been set up using flame gases to degrade the image. The image restoration technique was found to give a significant improvement in the quality of the image. Theoretical considerations demonstrate the effectiveness as well as the limitations in applying this procedure to restore degraded images. Author

N69-33335*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
FOURIER TRANSFORM HOLOGRAM CAMERA WITH AUTOMATIC VELOCITY SYNCHRONIZATION
Earl C. Klaubert and John H. Ward (Tech. Operations, Inc., Bulington) *In its* Evaluation of Motion-Degraded Images 1969 p 119–122 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

A concept has been devised which provides a method for recording nonsmeared holograms of particles of 50 to 100 microns diameter at velocities from 0 to 40 km/sec with automatic velocity synchronization using no moving parts. This concept uses some of the properties of Fourier transform holograms: however, in this case the coherent reference wavefront will be derived from back reflected light from the moving particle. The feasibility of the proposed method is currently being investigated. This paper describes the basic concept and the anticipated properties of the hologram system. The major points of the feasibility investigation are also described. Author

N69-33336*# Stanford Univ., Calif.
HOLOGRAPHIC IMAGERY THROUGH ATMOSPHERIC INHOMOGENEITIES
Joseph W. Goodman, D. W. Jackson, M. Lehmann, and J. W. Knotts *In* NASA Evaluation of Motion-Degraded Images 1969 p 123–127 refs Sponsored by AFAL (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

Certain holographic techniques show considerable promise for high resolution imaging through atmospheric inhomogeneities. If a reference wave is supplied from a point very close to the object, then under certain conditions the aberrations imparted to both the reference and object waves will be nearly identical. Interference of the two similarly aberrated waves yields a hologram which is free from distortion. Experiments have been conducted in the laboratory and over outdoor paths to determine the applicability of this technique in the real atmosphere. For horizontal paths, experiments have shown that the so-called "isoplanatic region" within which improved resolution can be obtained is often very small. Experiments have been conducted over a 12 km horizontal path using a Q-switched ruby laser as the source and a 48-inch diameter telescope as the light collector. Resolutions obtained varied from 3 seconds of arc to 0.5 seconds of arc, depending on atmospheric seeing conditions. The primary practical problem encountered was the limited dynamic range of the photographic detector, which led to a loss of both resolution and sensitivity on nights of bad seeing. Author

N69-33337*# California Univ., San Diego. Scripps Inst. of Oceanography.
POTENTIAL AND LIMITATIONS OF TECHNIQUES FOR PROCESSING LINEAR MOTION-DEGRADED IMAGERY
James L. Harris, Sr. *In* NASA Evaluation of Motion-Degraded Images 1969 p 131–138 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

This paper deals with computer processing of images degraded by linear image motion. An attempt is made to emphasize the fundamental aspects of the processing problem including questions of information content of the degraded images, the implication of errors in the processing. Such errors are induced by misestimation of the amount of image motion, inadequate correction for sensor nonlinearities, and the presence of noise. Various approaches to optimum filtering are discussed and several simple but sometimes effective nonoptimum filtering operations are described. Examples of computer processing are given to illustrate these topics. Author

N69-33338*# KMS Industries, Ann Arbor, Mich.
SOME CONSIDERATIONS IN POST-FACTO BLUR REMOVAL
Louis J. Cutrona and William D. Hall *In* NASA Evaluation of Motion-Degraded Images 1969 p 139–148 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

In this paper a number of considerations pertinent to post facto blur removal using coherent optical techniques are discussed. The blur is generated by image motion during its recording. While more general motion can be handled, this paper will concern itself with a smear along one direction only. The smearing operation can be represented as a filtering operation in the spatial frequency domain. An insistence on perfect reconstruction in the noiseless case leads to a correction filter which is the reciprocal of the smearing filter. The smearing filter unfortunately has zeros. The correction filter, being the reciprocal function, has poles. Such poles cannot be fabricated in optical filters. Relaxed requirements on the reconstruction can lead to relizable optical filter functions. One of the relaxations comes about by recognizing that a photograph is of finite extent. A further decrease in difficulty in making the optical filter occurs if one relaxes the required resolution to a finite value. The detailed nature of the optical filter functions resulting in each of the cases above is described in this paper. Author

N69-33339*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
COMPUTING TECHNIQUES FOR CORRECTION OF BLURRED OBJECTS IN PHOTOGRAPHS
Claron W. Swonger and Faith Y. Chao *In* NASA Evaluation of Motion-Degraded Images 1969 p 149–159 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

In the deconvolution by digital techniques of sampled blurred gray-level images of moving objects, noise disturbances prove to be a major obstacle. Since the linear deconvolution filter which would ideally be used is unstable or marginally stable and thus intensifies the effect of the noise, various techniques for noise compensation have been studied. In this paper, a set of such computing techniques, which employ adaptive filtering concepts, are considered and presented along with experimental results. These techniques involve a preliminary process which includes a determination of maximal edge area around the blurred object in the photograph, major reduction of noise samples of "large" magnitude, and some reduction of those of a low magnitude. Given the noise level, a set of weights can be automatically obtained for a noise compensation filter that minimizes, in the sense of least squares, the difference between the resulting processed image and the ideal noise-free still object image for one or more training sample images. This set of weights is then used to calculate the processed image with the same statistical noise level. Author

N69-33340*# Eastman Kodak Co., Rochester, N.Y.
RESTORATION OF IMAGES DEGRADED BY SPATIALLY VARYING SMEAR
Edmund M. Granger *In* NASA Evaluation of Motion-Degraded Images 1969 p 161–165 (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

The image recorded in the presence of spatially variant image motion is shown to be the result of a convolution of the image with a four-dimensional image motion function. The degraded image is restored on a four-dimensional correction space. Two dimensions on this space represent sample points taken on the image. The second set of dimensions is spatial frequency. The number of samples required in the correction process is shown to be a function of the magnitude and rate of change of the image motion and of the signal-to-noise ratio in the degraded image. The restoration is performed by suitably weighting the degraded image at each sample point. The weighted image is Fourier-transformed

and multiplied by a correction filter function. The result is back-transformed to form the restored image at the sample. The total restoration is achieved by summing the restoration for each sample. The variant image motion problem can be simulated on the computer. Restorations are displayed for signal-to-noise ratios of 10, 100, and 1000. Author

N69-33341*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
SOME PRACTICAL ASPECTS OF MEASUREMENT AND RESTORATION OF MOTION-DEGRADED IMAGES
Paul G. Roetling, Roger C. Haas, and Robert E. Kinzly *In* NASA Evaluation of Motion-Degraded Images 1969 p 167–174 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

This paper discusses several of the practical aspects of measurement of image quality and image enhancement for the case of images degraded by uncompensated image motion. Some theoretial limitations on the restoration process are considered and examples of attempts to restore detail blurred by image motion are shown. The method of edge gradient analysis is now more or less commonly applied to evaluate image quality. Examples of the application of edge gradient analysis to images blurred by uniform image motion and by vibration are shown and the importance of zero crossings of the modulation transfer function in the identification of the type of degradation is stressed. Some of the practical aspects of restoration attempts with motion-blurred pictures are demonstrated by examples utilizing the Lunar Orbiter I high resolution photographs which were badly blurred by image motion. Two techniques, namely, coherent optial spatial filtering and an incoherent optical differentiation technique, are compared and results are shown illustrating both true and spurious enhancement and illustrating interpretation techniques which allow enhanced noise to be distinguished from true enhanced images. These results also illustrate the relative advantage or disadvantage of each enhancement technique for restoring various types of detail degraded by image motion. Author

N69-33342*# Arizona Univ., Tucson.
AN ANALOG IMAGE PROCESSOR
Roland V. Shack and William Swindell *In* NASA Evaluation of Motion-Degraded Images 1969 p 175–178 (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14B

The analog image processor is a scanning-playback device, rather like a facsimile machine. However, the image is scanned with an extended and spatially varying patch of light rather than a small spot. The transmitted beam is used to reconstruct a restored image. The essential difference between this and other optical processing methods is that the processing is done with incoherent light and takes place in the plane of the blurred image. Author

N69-33343*# Information Technology Corp., Burlington, Mass.
OPTICAL PROCESSING OF MOTION-BLURRED IMAGERY
Philip S. Considine *In* NASA Evaluation of Motion-Degraded Images 1969 p 179–183 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

Compared are the properties of the hologram filter to those of in-line optical filters for processing of motion blurred images. One major advantage of the in-line filter is that it can be controlled, and its response corrected over the hole dynamic range of interest. Thus in-line filters function well for continuous tone image enhancement where accuracy is needed over the dynamic range. One function for which there is little comparison is the application of filters to target recognition for cases of high selectivity. Hologram filters, because they are formed in an optical system, have the high frequency response of optical systems that is necessary for high selectivity filters. Author

N69-33344*# California Univ., La Jolla.
HOLOGRAPHIC PENETRATION OF TURBULENCE
Olof Bryngdahl (IBM, Los Gatos, Calif.) and Adolf Lohmann *In* NASA Evaluation of Motion-Degraded Images 1969 p 185–187 refs Sponsored in part by ARPA (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

The amount of degradation of images obtained through random media by holographic technique has been studied. Sometimes the introduction of the relay lens might not be a suitable means for coping with a distant turbulent layer, because the distance may not be known, or a lens of proper dimensions might not be available. For that case we have developed the following three-step holographic method. Close to the object O is a reference point source, R_0. Light from O and R_0 travels through the turbulent layer to the hologram H_1, where also an undisturbed reference wave R_1, arrives. After developing the hologram H_1, it is illuminated with a replica of the former reference wave R_1, thus reconstructing the wavefield coming from O and R_0 through T. By means of a lens we can find the location of the turbulent layer T imaged onto a photographic plate. Since the irradiance falling onto the photographic plate is the same as the irradiance, which did exist during the primary recording process just behind the layer T, this photograph is equivalent to a hologram as recorded. Author

N69-33345*# California Univ., La Jolla.
COMPENSATION OF MOTION BLUR BY SHUTTER MODULATION
Olof Bryngdahl (IBM; Los Gatos, Calif.) and Adolf Lohmann *In* NASA Evaluation of Motion-Degraded Images 1969 p 189–192 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 14E

Ordinarily, when making a photographic recording, the shutter is opened for a finite time T, which can be described by a rectangular shutter function (= flux as a function of time). Such a shutter function in connection with linear image motion creates a degradation due to motion blur. If the shutter instead is opened twice as long and modulates the flux by a function $\cos^2(t^2)$, a recording is obtained which has the properties of an "incoherent one-dimensional hologram." Hence, compensation of motion blur is achieved by reconstructing a sharp image from the "hologram." Author

N69-33431*# National Aeronautics and Space Administration. Electronics Research Center.
ORIFICE GROSS LEAK TESTER
Thomas L. Altshuler, inventor (to NASA) Filed 7 May 1969 15 p (NASA-Case-ERC-10150; US-Patent-Appl-SN-822519) Avail: CFSTI CSCL 14B

An orifice leak tester for use with a helium mass spectrometer is described. The leak tester consists of a sample chamber, wherein an article to be tested is supported on a wire screen. An orifice provides communication between the sample chamber and the mass spectrometer specimen chamber. Means for directing a nitrogen purging gas over the orifice and through the sample chamber between tests are provided. The apparatus permits the testing of such items as encapsulated semiconductor devices for leak rates in excess of 10^{-5} cc/sec. NASA

N69-33432*# National Aeronautics and Space Administration Electronics Research Center, Cambridge, Mass.
A MULTICHANNEL PHOTOIONIZATION CHAMBER
Hongouk H. Kim and Sharda Nand (inventors (to NASA) Filed 1 Apr. 1969 11 p
(NASA-Case-ERC-10044; US-Patent-Appl-SN-811892) Avail: CFSTI CSCL 14B

The chamber is used for measuring absorption, photoionization yield, and photoionization coefficients of gases. The chamber includes ion collection plates which permit measurement of ion current ratios to determine whether the absorption cross section is independent of both pressure and path length, i.e., whether Beer's law is obeyed. Pressure gauges measure the chamber pressure at locations adjacent to each of the collector plates. The pressure values corresponding to ion current maxima for each collector plate are used to determine the absorption cross section of the filling gas. Identical values of cross section calculated in this way are another indication that Beer's law is obeyed. NASA

N69-33451# Societe Europeenne de Protection Contre des Rayonnements.
DETECTORS IN RADIATION PROTECTION AND RADIATION MEASUREMENT TECHNIQUES Conference Proceedings [HALBLEITERDETEKTOREN IN STRAHLENSCHUTZ UND STRAHLENMESSTECHNIK. Gemeinsame Tagung]
Juelich, West Ger. Sep. 1967 231 p refs In GERMAN and ENGLISH Proc. of Joint Meeting held at Neuherberg, Munich, 11–13 May 1967
(CONF-670545) Avail: CFSTI

Radiation semiconductors are discussed in terms of medical radiophysics, radiation protection, technology, and operational and physical characteristics. For individual titles, see N69-33452 through N69-33474.

N69-33453# Technische Hochschule Munchen (West Germany). Institut fuer Technische Elektronik.
SOLID-STATE ANALOG TO THE CLASSICAL GAS-FILLED RADIATION DETECTORS [DIE FESTKOERPERANALOGA ZU DEN KLASSISCHEN, GASGEFUELLTEN STRAHLUNGSDETEKTOREN]
I. Ruge *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 17–35 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

The solid-state analog to the ionization chamber is described and some special models of solid ionization chambers are given. Two detectors are presented, which are the first results of studies to obtain solid-state detectors with internal amplification by a charge carrier multiplication. These detectors were prepared in order to verify the solid-state analog to the proportional counter and to the G-M counter. NSA

N69-33457# Technische Hochschule Munchen (West Germany). Institut fuer Radiochemie.
SEMICONDUCTOR INSTALLATION IN ALPHA SPECTROMETRY [DIE HALBLEITERANORDNUNG IN DER ALPHA-SPEKTROMETRIE]
F. N. Flakus *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 69–72 In GERMAN (See N69-33451 19-14)
Avail: CFSTI

The development of α spectrometry beginning with the Rutherford experiments on the deflection of α radiation in magnetic and electrostatic fields is briefly outlined. Proportional counters and ionization chambers are frequently used at present in α spectrometry. The resolution obtainable with ionization chambers was compared by Alkazov with that obtainable with semiconductor detectors. The results showed that the semiconductor detector surpasses the ionization chamber with respect to energy resolution capacity and it has a better time resolution also. NSA

N69-33458# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
DETERMINATION OF PARTICLE POSITION AND PARTICLE ENERGY WITH SURFACE-BARRIER COUNTERS [BESTIMMUNG VON TEILCHENORT UND TEILCHENNENERGIE MIT GRENZSCHICHTZAEHLERN]
J. G. Festag *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measument Tech. Sep. 1967 p 73–80 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

The set-up for the determination of particle position and energy using surface-barrier counters is described. The results obtained with Am and ThB sources are given and discussed. NSA

N69-33459# Frieseke und Hoepfner G.m.b.H., Erlangen-Bruck (West Germany).
MEASUREMENTS OF THE LOWEST ACTIVITIES WITH SEMICONDUCTOR DETECTORS [MESSUNG GERINGSTER AKTIVITAETEN MIT HALBLEITERDETEKTOREN]
L. Kuhn *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 81–87 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

The application of semiconductor detectors to the measurement of very low level α, β, or α-β activities is discussed. The zero effect radiation is considered in unshielded and shielded counters. The relative γ sensitivities of semiconductors detectors are considered. NSA

N69-33461# Central Lab. for Radiological Protection, Warsaw (Poland).
CONSTRUCTION AND USE OF SEMICONDUCTORS FOR RADIATION PURPOSES
J. Roman *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 96–107 refs (See N69-33451 19-14)
Avail: CFSTI

The surface-barrier detectors prepared from n-type silicon (300–8000 ohmcm) with active area up to 4.5 cm^2 were used for spectroscopic and total activity measurements. The spectra of low energy beta emitters are presented. A special low background anticoincidence silicon counter has been constructed. A shallow silicon surface-barrier detector was used as an extrapolation ion chamber, for beta surface dose rate measurement. The counting efficiency and the background counts of silicon detectors were measured. Author (NSA)

N69-33462# Technische Hochschule Munchen (West Germany). Institut fuer Elektronik.
SOLID-STATE RELEASE COUNTER BASED ON THE GM PRINCIPLE [EIN FESTKOERPER-AUSLOESEZAEHLER NACH DEM GM-PRINZIP]
W. Feulner *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radition Protec. and Radiation Measurement Tech. Sep. 1967 p 109–115 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

The solid-state counter can be considered an analog to the GM tube. Its construction and operational principles are outlined and illustrated. The pattern of the probability density for the pulse length, the pulse screen images, and the exponential dependance of the mean pulse length on the pulse current are shown. The counting rate behavior of the solid-state release counter is determined. A block diagram is given of the pulse length control circuit. NSA

N69-33463# Philips Gloeilampenfabrieken N.V., Amsterdam (Netherlands). Instituut voor Kernphysisch Onderzoek.
SPECIAL SEMICONDUCTOR DETECTORS FOR GAMMA RAY AND PARTICLE SPECTROSCOPY
J. A. den Boer and W. K. Hofker *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep.1967 p 116–125 refs (See N69-33451 19-14)
Avail: CFSTI

A survey is given of work on α-particle, β-particle, and γ ray detectors, detectors for biological and in vivo measurements and detectors for dE/dx x E telescope systems. More in detail the checkerboard detector, a totally depleted semiconductor detector with position indication in two dimensions, is discussed. Author (NSA)

N69-33464# Giessen Univ. (West Germany). Wilhelm-Conrad-Roentgen-Klinik.
PREVIOUS EXPERIENCES ON MEDICAL-BIOLOGICAL USES OF MINIATURE SEMICONDUCTOR DETECTORS [BISHERIGE ERFAHRUNGEN UEBER MEDIZINISCH-BIOLOGISCHE ANWENDUNGEN VON MINIATURHALBLEITER-DETEKTOREN]
H. Pfeiff *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 126–136 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

A miniature surface-barrier counter was developed for biomedical studies in living tissues. The temperature dependence of the noise of the counter was measured. For illustration the energy spectra of ^{32}P and ^{35}S at various detector temperatures were given. The current-voltage curves of miniature semiconductor detectors were also determined at different temperatures. A scheme was given for the simultaneous measurement of two radioactive nuclides in two channels. NSA

N69-33465# Firma Siemes AG, Erlangen (West Gemany). Forschungslaboratorium.
COMPARISON BETWEN SURFACE BARRIER COUNTERS AND DRIFTED COUNTER DIODES [VERGLEICH ZWISCHEN GRENZSCHICHTZAEHLERN UND DIFFUNDIERTEN ZAEHLDIODEN]
P. Glasow *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 137–144 In GERMAN (See N69-33451 19-14)
Avail: CFSTI

A review is given of the latest methods for the preparation of surface-barrier counters and drifted counter diodes. The properties of the two semiconductors are briefly compared. NSA

N69-33466# Technische Hochschule Munchen (West Germany). Institut fuer Radiochemie.
CONSTRUCTION OF A HIGH RESOLUTION GAMMA SPECTROMETER AND EXAMPLES FOR ITS USE [AUFBAU EINES HOCHAUFLOESENDEN GAMMA-SPEKTROMETERS UND BEISPIELE FUER SEINE ANWENDUNG]
J. Kemmer *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 146–155 In GERMAN (See N69-33451 19-14)
Avail: CFSTI

A high resolution γ spectrometer with a Li-drifted Ge crystal was constructed. The Ge crystal, the mechanical structure with cryostats and shielding, and the associated electronics are described. As application of the use of the spectrometer, the γ spectra of the lanthanides ^{154}Eu, ^{159}Gd, ^{160}Tb, ^{110}Ag, and $^{124(122)}Sb$ were obtained and compared with the spectra obtained with a NaI(Tl) crystal. NSA

N69-33467# Max-Planck-Institut fuer Kernphysik Heidelberg (West Germany).
SOME γ-SPECTRA OF ACTIVATED CYCLOTRON PARTS [EINIGE γ-SPEKTREN AKTIVIERTER ZYKLOTRONTEILE]
J. G. Festag *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 156–163 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

The use of a Ge(Li) detector for the detection and determination of the radio-induced activity of cyclotron parts was described. The results obtained were compared with those obtained using a NaI(Tl) crystal. The comparison showed that with a Ge(Li) detector the long-lived activities important for radiation protection problems can be detected or separated much earlier than with NaI(Tl) crystals. NSA

N69-33468# Kernforschung-Sanlage, Juelich (West Germany). Institut fuer Reaktorbauelements.
SEMICONDUCTOR SPECTRA OF URANIUM FISSON PRODUCT MIXTURES [HALBLEITESPEKTREN VON URAN-SPALTPRODUKTGEMISCHEN]
H. Petri and G. Riepe *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 164–170 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

For routine determination of fission products (burn-up measurements) or fission gases (released in fuel elements) with scintillation counters, the spectrometry with Ge(Li) detectors as preorientation was tested. The higher resolution permits a survey on the effect of perturbing lines. If the activity or measurement duration permits, more data can be obtained by the exchange of a scintillation counter with a Ge(Li) detector. For illustration, Ge(Li) spectra of fuel elements under various conditions of burn-up, decay time, and cladding materials and spectra of fission gases for various decay times were given. Author (NSA)

N69-33469# Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Strahlenschutz.
MEASUREMENTS ON X-RAY SPECTRA WITH GERMANIUM DETECTORS [MESSUNGEN VON ROENTGENSPEKTREN MIT GERMANIUM-DETEKTOREN]
G. Drexler, F. Perzl, and W. Panzer *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 171–178 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

Measurements of X-ray spectra with germanium detectors were compared with those obtained with a NaI scintillation detector. The energy dependence of radiation measurement devices in the lower energy range was determined. The results showed that Ge detectors can be used advantageously in the low energy range and more accurate measurements are possible in an area which is of importance both for radiation protection and dosimetry. NSA

N69-33470# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany). Abteilung Strahlenphysik.

DETERMINATION OF THE ENERGY DISTRIBUTION OF RECOIL PROTONS IN HYDROGEN-CONTAINING MATERIAL IN NEUTRON IRRADIATION [BESTIMMUNG DER ENERGIEVERTEILUNG VON RUECKSTOSSPROTONEN IN WASSERSTOFFHALTIGEM MATERIAL BEI NEUTRONENBESTRAHLUNG]

J. Hacke *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 178–184 refs In GERMAN (See N69-33451 19-14)

Avail: CFSTI

The extent to which semiconductor detectors are applicable to the dose determination of fast neutrons in tissues was investigated. The advantages of semiconductor detectors are their small volume and the possibility of determining directly the energy spectrum of recoil protons in tissue and the LET distribution. The recoil proton spectrum, measured with a Si semiconductor detector, was determined in dependence on the energy. The spectra of recoil protons in polyethylene of various thickness at the same neutron flux was also measured. The spectra of recoil protons in polyethylene and tissue-equivalent materials at the same neutron flux were compared. The distribution functions of the recoil proton fluxes and the energy dose were determined. The energy dose per unit flux was measured in dependence on the depth. The LET spectrum of the energy dose at various depths of a water phantom was measured. NSA

N69-33471# Technische Hochschule Hannover (West Germany). Arbeitsgruppe fuer Bautechnischen Strahlungschutz.

APPLICABILITY OF A LITHIUM-6 FLUORIDE SURFACE-BARRIER COUNTER SPECTROMETER TO THE MEASUREMENT OF FAST NEUTRON SPECTRA IN SHIELDING LAYERS [ANWENDBARKEIT EINES LITHIUM-6 FLUORIDE-GRENZSCHICHTZAEHLERSPEKTROMETERS ZUR MESSUNG VON SCHNELLEN NEUTRONENSPEKTREN IN ABSCHIRMUNGSSCHILDEN]

G. Stiller *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 185–190 In GERMAN (See N69-33451 19-14)

Avail: CFSTI

A ^{6}LiF surface-barrier counter spectrometer was developed for the measurement of fast neutrons shielding layers. The spectrometer was constructed of commercially available constituents, which are described. The pulse height distributions obtained are shown graphically. The principal disadvantages of the spectrometer are outlined. NSA

N69-33472# Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht (West Germany).

APPLICATION OF SMALL SEMICONDUCTORS TO THE DIRECT MEASUREMENT OF NEUTRON FLUX PROFILES IN THE REACTOR CORE IN ZERO POWER EXPERIMENTS [VERWERDUNG VON KLEINEN HALBLEITERDETEKTOREN ZUR DIREKTEN MESSUNG VON NEUTRONENFLUSSPROFILEN IM REAKTORKERN BEI NULLEISTUNGSEXPERIMENTEN]

K. Henning and H.-J. Tauffenbach *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 191–199 In GERMAN (See N69-33451 19-14)

Avail: CFSTI

The direct measurement of the neutron flux with very small semiconductor detectors was proposed for zero power experiments with the FDR. The detector arrangement used is described and the principal circuit of a 20-channel installation is given. The advantages of the experimental arrangement with respect to interference safety are described. The differential pulse height distribution of a semiconductor detector was determined. The results show that semiconductor can be used advantageously in those reactors having sufficient space between the fuel rods for the detectors. NSA

N69-33473# Research Inst. of National Defence, Stockholm (Sweden).

NEUTRON DOSIMETER WITH SEMICONDUCTOR [NEUTRONENDOSIMETER MIT HALBLEITER]

M. Wik *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 200–216 In GERMAN (See N69-33451 19-14)

Avail: CFSTI

A neutron dosimeter in the form of a special semiconductor diode was developed for the detection of neutrons from nuclear bomb explosions or nuclear reactors. The current-voltage characteristics of diode type D1-3-0 were modified by fast-neutron irradiation. A schematic is given of the diode. The voltage-current characteristics before and after irradiation were determined. A theory of the voltage-current characteristics was developed. First test results to verify the theory were good. NSA

N69-33474# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Strahlenschutz.

SILICON DIODES FOR THE INTEGRATED MEASUREMENT OF FAST NEUTRONS IN PERSONNEL DOSIMETRY [SILIZIUMDIODEN ZUR INTEGRIERENDEN MESSUNG SCHNELLER NEUTRONEN IN DER PERSONENDOSIMETRIE]

K. Becker *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 217–227 refs In GERMAN (See N69-33451 19-14)

Avail: CFSTI

Some practical aspects of semiconductor neutron dosimeters were reported in which the integrated flux of fast neutrons was measured over the decrease of the charge carrier lifetime in the base region of p-i-n silicon diodes. Some results obtained with the relatively sensitive commercially manufactured diodes PH-50 were reported. NSA

N69-33480*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

APPARATUS FOR INSPECTING MICROFILM

Eugene L. Klein, inventor (to NASA) Filed 16 May 1969 12 p (NASA-Case-MFS-20240; US-Patent-Appl-SN-825259) Avail: CFSTI CSCL 14B

This device is designed for the semiautomatic inspection of density, resolution, size, and position. A single apparatus functionally combines a microscope, densitometer, light box, and automatic film transport system. The apparatus has a main housing supporting a motorized forward winding reel and a motorized reverse winding reel for transporting the film. A light box is secured to one side of the housing, and idler reels guide the film from the forward and reversed winding reels across its lighted surface. A large magnifying glass is supported in front of the light box so as to view the moving film. A microscope is pivotally mounted relative to the light box whereby any individual image may be viewed to determine the resolution of the lines. The densitometer is also pivotally attached to the light box to obtain film density readings. The densitometer may be electrically connected to obtain a direct reading on a meter attached to the front of the housing as well as lights to indicate proper tolerance limits. NASA

N69-33491*# Department of Agriculture, Washington, D.C. Natural Resouce Economics Div.
AN APPRAISAL OF THE POTENTIAL FOR AGRICULTURAL RESOURCE SURVEYS BY REMOTE SENSING Summary Report
Mar. 1969 55 p refs
(NASA Order R-09-038-001; NASA Order R-09-038-002)
(NASA-CR-103704) Avail: CFSTI CSCL 14B

One of NASA's major objectives has been to investigate and implement the adaptation of space technology for peaceful uses. With more specific objectives, this study was undertaken to provide guides for a long range program of research and operations in the acquisition of data on agricultural and related resources by remote sensing methods through defining potential applications, assessing the relative importance of these applications, and specifying the requirements for data in each application area. The specific research objectives were as follows: (1) to identify potential agricultural applications of remote sensing from space platforms; (2) to assess the quantitative and qualitative benefits potentially obtainable from an operational program of data collection in each application area; and (3) to rank application areas in accordance with apparent importance or payoff as a guide to research, development, and priority for operations. Author

N69-33547# Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland).
IMPROVED INTERFEROMETER FOR MEASURING ELECTRON DENSITY IN A PREIONIZED AXIAL DISCHARGE [MESURES DE DENSITE ELECTRONIQUE DANS UNE DECHARGE AXIALE DE PREIONISATION A L'AIDE D'UN INTERFEROMETRE AMELIORE]
A. Heym Nov. 1967 20 p refs In FRENCH; ENGLISH summary
(LRP-33/67) Avail: CFSTI CSCL 14B

A Mach-Zehnder interferometer is described which is used for electron line density measurements of a rapidly varying plasma. The density profile of the plasma is obtained by scanning a 3 mm wide He-Ne laser beam across the diameter of the discharge tube. Fringe detection is made with a system of two photomultipliers which allows one to follow the sense of variation of the electron line density in an unambiguous manner. This interferometer is used to measure the electron line density of an axial current discharge in 25 mTorr H^2. Complete ionization of the gas is found after 9 μsec. The gas remains in a fully ionized state until the discharge current is crowbarred. Electron loss is observed to be governed by ambipolar diffusion for time greater than 10 μsec after crowbar. Author

N69-33558# Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland).
PRESSURE MEASUREMENT BY A BATTERY-POWERED COMPENSATED THERMOCOUPLE AND CHOPPER AMPLIFIER SYSTEM [MESURE DE LA PRESSION PAR UN SYSTEME A THERMOCOUPLE COMPENSE ET A AMPLIFICATEUR DECOUPEUR, ALIMENTE PAR BATTERIES]
H. Ripper Aug. 1967 13 p refs In FRENCH; ENGLISH summary
(LRP-32/67) Avail: CFSTI CSCL 14B

Described is the construction of a battery-powered gage which measures the pressure in a discharge tube. This gage is based on a compensated thermocouple used in conjunction with a chopper-amplifier. Typical calibration curves are shown. Author

N69-33588*# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
DEVELOPMENT AND USE OF AN EXTENSOMETER FOR DETERMINING THE MECHANICAL COMPLIANCE OF CRACK TOUGHNESS TEST SPECIMENS
J. R. Houghton and L. K. Irwin Sep. 1968 34 p refs
(NASA Order R-09-022-042; NBS Proj-2130440)
(NASA-CR-103826; NBS-9806) Avail: CFSTI CSCL 14B

The characteristics and capabilities of displacement and deformation measuring devices were surveyed for mechanical compliance calibrations of crack toughness specimens. A prototype extensometer was designed and constructed with a demonstrable sensitivity of better than 1.0 μin. and operating range of about 0.0074 in. It incorporates two linear variable differential transformers, one as a displacement sensor and one for the reference voltage. The procedures for calibrating the extensometer and for using it to measure deformations of single-edge-notch (SEN) tensile specimens are described. Preliminary results of mechanical compliance calibrations of a 4 inch (102 mm) gage length, and an 8 inch (203 mm) gage length, SEN tensile specimens are given and comparisons are made with other recent compliance calibrations. Author

N69-33577*# Wisconsin Univ., Madison. Dept. of Meteorology.
DETERMINATION OF THE SEA SURFACE SLOPES DISTRIBUTION AND WIND VELOCITY USING SUN GLITTER VIEWED FROM A SYNCHRONOUS SATELLITE
N. Levanon *In its* Meteorol. Satellite Instrumentation and Data Process. Dec. 1968 p 1-15 refs (See N69-33576 19-20)
Avail: CFSTI CSCL 14E

An adaptation of the Cox-Munk technique of sea-slope distribution estimation, which uses sun glitter photographs taken from an aircraft, to pictures taken from a much higher altitude by a synchronous satellite is examined. The main modification involves the use of a sequence of photographs of a limited area (taken over a time period) rather than a single photograph of the whole sun glitter area. Data from the satellite were used to calculate the slope distribution, and from it the wind velocity, for the locations of Palmyra, Fanning, and Christmas Island, on 18 and 19 April 1967. The calculated values were compared to direct wind measurements obtained at these locations. Utilizing the data from the scanning-type electronic camera, it was possible to bypass the highly degrading photographic and photometric processes and to do all the quantitative work on the received video signal. K.R.G.

N69-33626# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
PROCEEDINGS OF THE FIFTH SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT
Sep. 1968 949 p refs Symp. held 16-18 Apr. 1968; Sponsored by ONR, AFCRL, Army Engr. Topographic Lab., Geol. Survey, and Dept. of Agr.
(Contract Nonr-1224(44))
(AD-676327; REPT-4864-18-X) Avail: CFSTI CSCL 14/2

The numerous aspects of remote sensing were discussed with emphasis placed on advances during the past five years, advances in technology, and applications for these technologies. For individual titles, see N69-33627 through N69-33689.

N69-33627# Laboratory for Aerial Techniques, Leningrad (USSR).
APPLICATION OF INFRARED AERIAL RECORDING TECHNIQUES TO STUDIES OF VOLCANOES AND THERMAL ACTIVITIES OF KAMCHATKA PENINSULA
B. V. Shilin and V. B. Komarov *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 8 p ref (See N69-33626 19-14)
Avail: CFSTI

A principal area of development of aerial methods is in the rarely used intervals of the electromagnetic spectrum, primarily the infrared. In this region, thermal radiation from the scene elements is recorded in the intervals from 1 to 14 μ where there

exist two atmospheric windows (1 to 5.5 μ and 7 to 14 μ). In the studies of natural resources by the infrared aerial techniques, all recorded objects may be divided into two types. The first type includes objects which have high temperature, such as volcanic sources, sources of thermal waters and hot gases, under ground fires, and forest fires. The second variety includes the objects which obtain their thermal contrast from solar radiation. In the first the thermal contrasts 20°C, depend many degrees and are comparatively stable with time. In the second case they seldom exceed 20°C, depend strongly on weather conditions, and change quite rapidly so that within one day's time they can completely disappear or even become inverted. Author

N69-33628# Eastman Kodak Co., Rochester, N.Y. Research Labs.
PHOTOGRAPHY: AN ELECTRONIC-IONIC MEDIUM FOR REMOTE SENSING APPLICATIONS
R. G. Tarkington *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 3–7 refs (See N69-33626 19-14)
Avail: CFSTI

The use of photography as an indispensible component for most remote sensing operations, and corollary functions is studied as an electronic-ionic process of solid state physics depending on two fundamental phenomena: characteristics of silver halide crystals, and the use of an electronic-ionic amplifier of great power. Remote sensing systems such as aerial photography, side-looking radar, and meteorological satellites sending television images to earth are discussed. The ability to store information in small space with high packing density is considered to be an outstanding property of photographic materials. F.O.S.

N69-33629*# Ewen Knight Corp., East Natick, Mass.
MICROWAVE RADIOMETRIC CAPABILITIES AND TECHNIQUES
H. I. Ewen, F. Haneman (Airborne Instr. Lab., Melville, N.Y.), R. J. Kalafus (NASA), M. E. Louapre (Aerojet-Gen. Corp., El Monte), R. Mailloux (NASA) et al *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 9–58 refs (See N69-33626 19-14)
(Grant NGR-22-009-163)
Avail: CFSTI CSCL 14B

The principles of operation and present capabilities of microwave radiometric sensors are presented. Separate sections are devoted to a discussion of antennas and radiometric receivers as the two major functional subsystems of the sensor. Projected capabilities offered by near future solid state component advances are included in the section on receivers. Author

N69-33630*# Aerojet-General Corp., El Monte, Calif. Space Div.
PHASED ARRAYS FOR SPACEBORNE MICROWAVE SENSORS
Merlin E. Louapre *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 59–68 refs (See N69-33626 19-14)
(Contract NAS5-9680)
Avail: CFSTI CSCL 14B

The two-dimensional phased array antenna is a device of high beam efficiency and volumetric compactness, and is ideally suited for use in spaceborne and airborne microwave radiometric sensor systems. This paper describes the development of both electronically-scanned and fixed, multiple beam phased arrays. A brief discussion of array theory as it applies to the problem is presented. Emphasis, however, is given to the practical aspects of achieving the high beam efficiency required in radiometric applications and a discussion of the performance that is attainable. Author

N69-33632# Michigan Univ., Ann Arbor. Willow Run Labs.
LINE SCAN DEVICES AND WHY USE THEM
D. S. Lowe *In its* Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 77–101 refs (See N69-33626 19-14)
Avail: CFSTI

The technological development of scanners, and the relationship between scanner performance and component specifications are summarized. Some modifications for converting the conventional scanner into a quantitative research tool are discussed. Author

N69-33633# HRB-Singer, Inc., State College, Pa.
INVITED COMMENTS: LINE SCAN DEVICES AND WHY TO USE THEM
Ronald W. Stingelin *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 103–105 (See N69-33626 19-14)
Avail: CFSTI

The signal processing problems, and an expansion on the dc restoration in line scanner systems used in terrain science work are discussed. The averaging effect of the ac coupled systems is considered a disadvantage, and the improvement by dc restoration and the prevention of saturation in the amplifier with signal limiting techniques are suggested. F.O.S.

N69-33635# Barringer Research, Ltd., Rexdale (Ontario).
SURVEILLANCE POLLUTION FROM AIRBORNE AND SPACE PLATFORMS
A. R. Barringer, B. C. Newbury, and A. J. Moffat *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 123–155 refs (See N69-33626 19-14)

Avail: CFSTI

The build-up of air pollution which is taking place throughout the world constitutes a growing threat to health and a source of destructive corrosion. Not only is this pollution taking place in the lower atmosphere but large quantities are now being introduced into the upper atmosphere by heavy air traffic and rocket launching activities. There is a requirement for a new method of measuring air pollution to provide world wide surveillance in both the upper and lower atmosphere. A new device has been developed called the correlation spectrometer which is capable of measuring remotely a variety of pollutants from both airborne and orbital altitudes. Experimental surveys have been carried out over Washington, D.C. and Toronto which verify the potential application of this instrument to surveillance programs. The equipment is described and the results of experimental surveys are given. Author

N69-33637# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
AIRCRAFT POLARIMETRIC AND PHOTOMETRIC OBSERVATIONS
W. G. Egan *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 169–189 refs (See M69-33626 19-14)
Avail: CFSTI

A portable, electronic, large scale nonimaging polarimeter/photometer was used in a light aircraft for observations

of a pure red pine (*Pinus resinosa*) stand, the Atlantic Ocean, snow, and sea ice. The optical sensing head, with an angular acceptance angle of 1 degree, was designed to permit adaptation for laboratory and surface vehicle measurements in the spectral region from 0.3 to 3 microns. The wavelength bands are selected by the use of broadband or interference filters. Initial aircraft observations were made at wavelengths of 0.533 and 1.0 microns, between altitudes of 1000 and 9000 feet under cloudless conditions with the nonimaging sensor. Simultaneously, a photographic record was made of the sensed area with a 16 mm camera. Author

N69-33639# Michigan Univ., Ann Arbor. Law School.
LEGAL AND SOCIAL POLICY RAMIFICATIONS OF REMOTE SENSING TECHNIQUES
Samuel D. Estep *In its* Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 197–217 (See N69-33626 19-14)
Avail: CFSTI

The legal aspects of the development of remote infrared sensors are discussed. Possible abuses and means of coping with them are presented in detail. It is emphasized that early cognizance of the kinds of policy and legal problems which are created by the advent of this remote sensing technology is essential for their solution and that adequate financial support for research is needed in this area. K.R.G.

N69-33642# California Univ., Berkeley.
DETERMINING THE USEFULNESS OF SPACE PHOTOGRAPHY FOR NATURAL RESOURCE INVENTORY
Robert V. Colwell *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 249–289 refs (See N69-33626 19-14)
Avail: CFSTI

Only a limited amount of direct evidence is available as to the potential usefulness of space photography for natural resource inventory. Even less is known regarding the best procedures for its use. Some authorities maintain that natural resource inventories of the future can better be made on photography taken from high-flying aircraft than on that taken from spacecraft. Others assert that a combination of both aerial and space photography, augmented as necessary with direct on-the-ground observations, will be required. The present situation would seem to call for the employment of more vigorous efforts and more rigorous procedures as we seek to determine the usefulness of space photography for natural resource inventory. A procedure which was employed when seeking to determine, for specific geographic areas, the usefulness of space photography for various kinds of natural resource inventory is described. Photographic examples are given to illustrate the successive steps in that procedure, and suggestions for the improvement of it are solicited. Author

N69-33644# Department of Agriculture, Washington, D.C. Natural Resource Economics Div.
APPLICATIONS OF ECONOMIC ANALYSIS TO PROBLEMS OF DATA COLLECTION BY REMOTE SENSING TECHNIQUES
Walter Gensurowsky *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 299–305 refs (See N69-33626 19-14)
Avail: CFSTI

Some problems associated with data collection by means of remote sensing techniques are presented. Economic considerations are indicated and a linear programming method suggested for arriving at decisions. The mathematical formulation of a linear programming model is presented in an appendix. The model presented was formulated to minimize total cost. It is concluded that the application of economic analysis to problems of data collection by remote sensing techniques can result in solutions that will assist a decision maker. Elements of risk and of multiple alternatives can be considered within the framework of a linear programming model. The remote sensing application suggested requires considerable information on input alternatives, their costs, interrelationships, and probabilities of success. While much of this information is available, more information could be required before mathematical programming would be used to determine optimum data collection in some situations. Author

N69-33645# Department of Agriculture, Washington, D.C.
USE OF REMOTE SENSING FOR LIVESTOCK INVENTORIES
H. F. Huddleston and E. H. Roberts (Calif. Univ., Berkeley) *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 307–323 (See N69-33626 19-14)
Avail: CFSTI

A program to demonstrate the feasibility of detecting, identifying, and counting livestock from aerial photography is examined. Aerial photographic techniques which employ several films, filters, lenses, and scales and which also entail new approaches to image analysis are presented. The techniques were tested in the Sacramento Valley of California covering an area of approximately 1000 square miles. The area was divided into two basic land use types: (1) predominantly cultivated farmland and (2) predominantly rangeland. Sixteen area sampling units were selected at random out of each stratum. Conventional inventory techniques were used to acquire inventory numbers by species as well as to classify each field on each ranch (or farm) tract into one of four domains of interest. The domains corresponded to the extent to which remote sensing was believed to be feasible. Preliminary analyses of the results indicate that comparable inventory numbers are obtained by ground enumeration and photointerpretation except for those domains where part of the animals were shielded from aerial view. K.R.G.

N69-33646*# Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research Div.
DETAILED PLANT AND SOIL THERMAL REGIME IN AGRONOMY
C. L. Wiegand, M. D. Heilman, and A. H. Gerbermann *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 325–342 refs (See N69-33626 19-14)
(NASA Order R-09-038-002)
Avail: CFSTI CSCL 14E

Variables in crop species, plant spacing, tillage, irrigation regime and special features such as highways and a water reservoir were used to study the thermal behavior of 40 sites on a 50-acre experimental research farm near Weslaco, Texas, during overflights made by the University of Michigan thermal scanner-bearing plane June 1, 1966. The thermal scanner imagery was interpreted from microdensitometer film densities calibrated against Stoll-Hardy radiometer measurements made on the ground at the same time the scanner-bearing airplane was overhead. The results illustrate the range in temperature expected in the agricultural landscape in a subhumid climatic zone and the magnitude of influence of time of day, crop cover conditions, tillage, and irrigation on the thermal behavior of plants and soils. The data also point up the need for internal calibration of the thermal scanner and for knowledge of the insolation conditions associated with the imagery. Author

N69-33647# Kansas Univ., Lawrence. Engineering Science Div.
ADAPTIVE PATTERN RECOGNITION OF AGRICULTURE IN WESTERN KANSAS BY USING A PREDICTIVE MODEL IN CONSTRUCTION OF SIMILARITY SETS

R. M. Haralick *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 343-356 (See N69-33626 19-14)
(Grant DAAK02-68-C-0089; Proj. Themis)
Avail: CFSTI

A mathematical description of a model for pattern recognition is described. The model was programmed for the GE 625 and four possible combinations of transmitted and received like and complementary polarized K-band radar images of agriculture in western Kansas were used as data. Results confirm that various categories of vegetation such as alfalfa, grain sorghum, wheat stubble and corn cannot be distinguished from one another on the basis of their structure within the radar data. This suggests that for pattern recognition purposes, certain categories may be expanded with little or no information loss and an increase in efficiency of the pattern recognition process. Further it also suggests that if the investigator wants to distinguish between the confused categories such as alfalfa, grain sorghum, wheat stubble and corn, an additional sensor must be used which can make the distinction. Author

N69-33648# Agriculture Dept., Berkeley, Calif. Forest Service.
REMOTE SENSING AND THE FOREST SURVEY: PRESENT APPLICATIONS, RESEARCH, AND A LOOK AT THE FUTURE
R. C. Aldrich *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 357-372 refs (See N69-33626 19-14)
Avail: CFSTI

This paper reports a study to determine the benefits of nonstereo cubic-foot volume classification on conventioal photography. Sampling efficiency increased from 1.00 for random sampling without stratification to 1.87 for a sampling design using nonstereo stratification after ground sampling. Stereo stratification increased the survey efficiency to 1.94. The present system of classifying land-use (forest and nonforest) resulted in an efficiency of 1.60. The gains from forest volume stratification are not enough to change present procedures. Author

N69-33649# California Univ., Berkeley. School of Forestry.
APPLYING REMOTE SENSING TECHNOLOGY FOR IMPROVING RANGE RESOURCE INVENTORIES
David M. Carneggie *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 373-385 refs (See N69-33626 19-14)
Avail: CFSTI

Improved inventories of rangeland are required in order to increase productivity of forage and animal products. Much of the information needed to improve range inventories can be collected using various remote sensing devices. Aerial photography and other kinds of imagery obtained from single and multilens cameras, optical mechanical scanners, thermal infrared imagers and radar sensors were examined and carefully field checked. The usefulness of each type is discussed in terms of the suitability for collecting relevant data about the range resource. Photographic systems which obtain high resolution images within selected regions of the visible and near infrared spectrum were judged most useful for improving range inventories. Images from line scanners, thermal infrared imagers and radar sensors are more useful for certain kinds of special purpose inventories. Author

N69-33650*# Agriculture Dept., Berkeley, Calif. Forest Service
PREVISUAL DETECTION OF PONDEROSA PINE TREES DYING FROM BARK BEETLE ATTACK
R. C. Heller *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 387-434 refs (See N69-33626 19-14)
(NASA Order R-09-038-002)
Avail: CFSTI CSCL 14E

Studies are underway in the Black Hills of South Dakota to determine the ground instrumentation, aerial sensing equipment, and techniques required to detect vigor loss and previsual signs of tree mortality caused by bark beetles in coniferous timber stands. Ground data were collected on spectral reflectance, Munsell color notations, emitted and absolute temperature, transpiration, and needle moisture tension of ponderosa pine trees and foliage. To date no aerial sensor was successful in detecting stressed conifers before the foliage discolors. A microdensitometer was used to analyze field resolution targets and known dying trees on the thermal imagery. A beginning was made to relate film density to object temperature. Author

N69-33651# HRB-Singer, Inc., State College, Pa.
AN APPLICATION OF INFRARED REMOTE SENSING TO ECOLOGICAL STUDIES: BEAR MEADOWS BOG, PENNSYLVANIA
Ronald W. Stingelin *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 435-440 refs (See N69-33626 19-14)
Avail: CFSTI

Comparative analysis of infrared line scan imagery and panchromatic photography of the newly established (1967) national landmark, Bear Meadows Bog, Centre County, Pennsylvania, reveals thermal tonal signatures that may be correlated with existing vegetation patterns and specific ground conditions. Summer and wintertime imagery are compared and the response of ericaceous and coniferous vegetation to trans-freezing temperatures studied. Drastic changes in the emitted signal from the bog are recorded for nights with sub-freezing air temperatures. A loss of the strong emitted signal from the ericaceous vegetation is attributed to the minimal absorbance of solar radiation during the day due to the curled attitude of the leaves. Such an attitude was acquired as a physiological reaction to the intense cold. Coniferous trees continued to emit a warm signal with the large pines and hemlocks providing strong returns. During both seasons detailed delineation of vegetational communities under daylight imaging conditions appears inferior to nighttime imaging. Early evening flights on nights with temperatures above freezing appear to be optimum for vegetational studies. Author

N69-33652# HRB-Singer, Inc., State College, Pa.
COLOR AERIAL PHOTOGRAPHY FOR AQUATIC VEGETATION SURVEYS
John E. Lukens *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 441-446 (See N69-33626 19-14)
Avail: CFSTI

Discussed are two applications of color aerial photography that are of interest to workers in water resources, especially those seeking a rapid and economical aid for the definition and modification of the ecology of large bodies of water. Gross areas of species associations were mapped in water up to 18 feet deep in the Finger Lakes of New York, using techniques similar to those used in photo-soils mapping. The various factors that must be considered for photographing, interpreting, and mapping submerged and emersed vegetation are briefly discussed. A second application of color aerial photography deals with the assessment of weed control measures for floating aquatics in Chesapeake Bay. Author

N69-33653# Northern Forest Fire Lab., Missoula, Mont.
PROJECT FIRE SCAN: SUMMARY OF 5 YEARS PROGRESS IN AIRBORNE INFRARED FIRE DETECTION
Stanley N. Hirsch *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 447-457 refs (See N69-33626 19-14)
Avail: CFSTI

Airborne infrared line scanning systems were developed and tested for detecting latent forest fires and for determining the size and characteristics of conflagrations when smoke or darkness prevents obtaining this information visually. A fire detection system was flight tested and more than 600 targets were detected and their positions plotted. A unique target discrimination module for automatically identifying hot targets was developed and evaluated. Experience already gained from patrol flights supplied the necessary parameters for designing a better operational system for infrared fire detection. Author

N69-33654# Department of Agriculture, Washington, D.C. Div. of Fire Control.
INFRARED MAPPING OF LARGE FIRES
Robert L. Bjornsen *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 459–464 refs (See N69-33626 19-14)
Avail: CFSTI

Mapping of large forest fires by airborne infrared scanners has reached operational status. IR mapping fills an intelligence requirement for delineating the fire perimeter, defining rate of spread, showing relative intensity, and locating spot fires outside the main perimeter. The imagery supplements intelligence from conventional airborne and ground reconnaissance and substitutes for these sources during periods of dense smoke obscuration and at night. The scanner also shows potential for mapping huge conflagrations resulting from peacetime and/or wartime catastrophes. Author

N69-33655# Northern Forest Fire Lab., Missoula, Mont.
FIRE DETECTION FEASIBILITY TESTS AND SYSTEM DEVELOPMENT
Ralph A. Wilson *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 465–477 refs (See N69-33626 19-14)
Avail: CFSTI

Requirements for successful airborne infrared fire detection include operation within a wide variety of environmental conditions. Large variations of atmospheric water concentration seriously alter capability of fire detection. Obscurations caused by timber canopy provide a large number of submarginal target signatures, particularly at large aspect angles. A target discrimination technique promises solution to the problem of detecting marginal targets. Author

N69-33656# Arctic Inst. of North America, Washington, D.C.
REMOTE SENSING OF THE POLAR REGIONS
John C. Reed *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 479–481 (See N69-33626 19-14)
Avail: CFSTI

The difficulty of Polar exploration was cut down by the introduction of new tools and techniques presented in this conference. Remote sensing is the most promising because of its economical prospects. The technique was used and it shows good results in detecting some of the features of the Polar Regions. E.H.W.

N69-33657# Michigan Univ., Ann Arbor. Willow Run Labs.
MULTISPECTRAL SURVEY IN THE ALASKAN ARCTIC
R. Horvath and D. S. Lowe *In its* Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 483–496 (See N69-33626 19-14)
Avail: CFSTI

An aerial survey in the vicinity of Point Barrow, Alaska during the fall of 1967 is described. Calibrated multispectral data were obtained for common Arctic features such as sea ice, thaw lakes, and polygonal soils under a variety of conditions. Quantitative and qualitative ground truth data were also acquired. Full scale analysis of these data has not yet been undertaken, but representative image examples are presented and the results of limited analysis described. Author

N69-33658# Naval Oceanographic Office, Washington, D.C.
OCEANOGRAPHIC APPLICATIONS OF REMOTE SENSING
James B. Zaitzeff and John W. Sherman, III *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 497–527 refs (See N69-33626 19-14)
Avail: CFSTI

Ocean phenomena amenable to remote sensing from air and spacecraft include sea surface temperatures, wave conditions, water/ice/land interfaces, biological indices, and water color analyses. A tentative selection of remote sensors showing promise for oceanographic measurements is presented. Active (radar and laser) and passive sensors from the visible, infrared, and microwave regions of the spectrum are included. The use of sonar for fish-school location and bottom profile mapping are examples of remote sensing from shipboard. Airborne photography is used for coastal mapping, nearshore depth determination, and locating schooling fish. Infrared thermometers and imaging scanners are used to chart the temperature and thermal pattern of the sea surface. Radar and passive microwave systems are being tested for sea state determination, coastal mapping, and sea ice charting. Earth orbiting satellite data from Nimbus, Gemini and Applications Technology Satellites have been particularly valuable in demonstrating the utility of television, photography, and infrared radiometry for oceanic observations. Comparisons of Nimbus high resolution infrared data to surface ships and aircraft surveys show remarkably accurate agreement in the position of major current thermal boundaries. These thermal conditions are closely related to biological productivity and fish habitats. Author

N69-33659# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
INVESTIGATING THE OCEAN BOTTOM WITH SIDE-SCANNING SONAR
John E. Sanders and C. S. Clay *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 529–547 refs (See N69-33626 19-14)
(Contract Nonr-266(84))
(CONTRIB-326) Avail: CFSTI

Much of our knowledge about the sea floor has been derived from research carried out from surface ships that are equipped to trace profiles of bottom morphology with the vertically incident sound beams of precision echo sounders and to lower deep-sea cameras to the vicinity of the bottom. Photography and television provide visual images of the sea floor showing minute details within small areas (1 to 3m on a side). Echo-sounding profiles portray one component of the shapes of large-scale features immediately beneath the ship. Seismic profiling discloses the subbottom configuration of sedimentary layers and of the morphology of the bedrock floor on which these layers rest. Side-looking sonar is especially well adapted for displaying the characteristics and plan views of features having sizes intermediate between those shown on visual images and those profiled by echo sounders. Author

N69-33660# Naval Oceanographic Office, Washington, D.C.
AN INFRARED TECHNIQUE FOR TRACKING THE GULF STREAM
R. L. Pickett *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 549–554 refs (See N69-33626 19-14)
Avail: CFSTI

A technique for locating and tracking the Gulf Stream was devised using an infrared radiation thermometer aboard a super-constellation aircraft. The Stream is detected by the strong temperature gradient that occurs along the northern boundary. In the vicinity of this gradient, the infrared thermometer is used to navigate the aircraft. Heading changes are made in response to a read-out unit mounted before the pilot. Positions of the northern edge of the Gulf Stream between 65° and 75°W obtained with this technique were statistically analyzed. The results show that the Stream has meanders that average 520 km in length and move from west to east at 15 cm/sec. Author

N69-33661# National Research Council of Canada, Ottawa (Ontario).

OCEAN WAVE PROFILE AND SPECTRA MEASUREMENT USING AN AIRBORNE MAGNETOMETER

Ralph Baker and P. W. U. Graefe *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 555–570 refs (See N69-33626 19-14)

Avail: CFSTI

The movement associated with ocean waves of conductive sea water interacts with the ever present earth's magnetic field to procude circulating electric eddy currents. These eddy currents in turn set up magnetic fields which reinforce the earth's magnetic field on the leading edge of the wave and oppose the earth's magnetic field on the leading edge of the wave the total field variation along the direction of wave propagation being sinusoidal for a sinusoidal water wave. This change in the earth's magnetic field due to the wave motion can be detected by floating, submerged, or airborne magnatometers. In measuring the magnetic fields of ocean waves with a moving airborne magnetometer, several characteristics of wave motions and of the resulting magnetic fields must be considered. Since velocity and wavelength of a given component wave are functions of the wave period, the apparent frequency of the magnetic signal seen by the airborne magnetometer will depend on the velocity and wavelength of the wave, and the velocity and relative heading of the aircraft. Data graphs are presented for several tests. M.W.H.

N69-33662# Long Island Univ., Greenvale, N.Y.

COASTAL WATER PENETRATION USING MULTISPECTRAL PHOTOGRAPHIC TECHNIQUES

Edward Yost and Sondra Wenderoth *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 571–586 refs (See N69-33626 19-14)

(Contract N00014-67-C-0281)

Avail: CFSTI

The exposure and spectral filtration to maximize the depth at which submerged objects can be detected has been established for northern coastal waters which contain large quantities of suspended particulent matter. Quantitative measurement of the comparative penetration capability of selected filtration shows that the log exposure latitude in the green spectral band is twice that of the red and three times that of the blue band. The optimum exposure of underwater objects for all spectral bands was found to occur when the surface was overexposed to place the ambient water illumination at least at unity density on the recording emulsion. The underwater log exposure latitude was observed to be reduced by one-half for each five feet increase in depth. Author

N69-33663# Barnes Engineering Co., Stamford, Conn.

EVALUATION OF AN INFRARED SPECTROMETER AS A CLEAR AIR TURBULENCE DETECTOR, PART 1

M. Weiss *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 587–597 refs (See N69-33626 19-14)

Avail: CFSTI

A variety of techniques which were treid for the detection of Clear Air Turbulence including microwaves, lasers, electric fields, light beams and infrared etc., are surveyed, and then the infrared method is discussed in detail. The primary objective is to provide a way of remotely detecting clear air turbulence and to obtain adequate advance warning of the presence of clear air turbulence so as to prevent encounters with it. Indications are that of the variety of techniques explored, infrared appears to be one of the most promising. The infrared instrument and its principle of operation are described. Data traces are presented of the actual flight records which show the pattern of the instrument response for instances of detection of mountain waves, clear air turbulence and the response of the instrument as it approaches the side of a mountain as a known boundary having a well defined temperature discontinuity. An improved instrument was developed based on the results of the flight test results. This instrument is presently under test and flight test data will be presented when available. The basic improvements include much simpler optical sampling, precise pitch stabilization of the line of sight, and a mechanical design configuration and size more suitable for use in operational rather than research oriented aircraft. Author

N69-33664# National Research Council of Canada, Ottawa (Ontario).

EVALUATION OF AN INFRARED SPECTROMETER AS A CLEAR AIR TURBULENCE DETECTOR, PART 2

G. K. Mather *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 599–608 *ref* (See N69-33626 19-14)

Avail: CFSTI

Flight tests were made with infrared spectrometers to be used as detectors of clear air turbulence. A fourteen channel tape recorder was used to record the spectrometer outputs, and various atmospheric turbulence parameters measured by other instruments on the aircraft. Instrument configurations and test data charts are presented. M.W.H.

N69-33670# Ohio State Univ., Columbus.

REMOTE SENSING FOR ENGINEERING INVESTIGATION OF TERRAIN PHOTOGRAPHIC SYSTEMS

O. W. Mintzer *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 687–699 refs (See N69-33626 19-14)

Avail: CFSTI

Summarization of the history, application, and principles of photointerpretation, the applications of aerial panchromatic, color, and false color photography, and geophysical survey data interpretations combined for terrain investigation techniques are presented. The potential value of multispectral, radar, and infrared imagery and combinations of sensors of soils investigations are considered. The purpose of engineering investigations of terrain is to obtain pre-design information useful in planning engineering construction. The savings of time, money, and/or human efforts, when compared to the conventional ground data collection methods provide adequate justification for the application of remote sensing methods. Multispectral, color, and color infrared photography are used. Radar and infrared thermal imagery also will be used in future terrain investigations. Author

N69-33671# Michigan Univ., Ann Arbor. Inst. of Science and Technology.

REMOTE SENSING FOR ENGINEERING INVESTIGATIONS OF TERRAIN INFRARED SYSTEMS

D. C. Parker *In its* Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 701–709 refs (See N69-33626 19-14)
(Contract Nonr-1224(44))
Avail: CFSTI

Aerial photography used extensively in planning an engineering operation is discussed along with infrared systems for analysis of form and composition of the terrain. Instrumentation techniques, availability of surveys, demonstration of utility relevant to engineering problems involving terrain, interpretability of the data, and economic feasibility are examined. Author

N69-33672# Aerojet-General Corp., El Monte, Calif. Space Div.
ENGINEERING APPLICATIONS OF MICROWAVE RADIOMETRY
A. T. Edgerton *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 711–724 refs (See N69-33626 19-14)
Avail: CFSTI

Recent research concerning the utilization of microwave radiometers for terrain analysis suggests a number of engineering applications for these instruments. These studies show that measured microwave temperatures are dependent on sensor frequency and polarization, and that sizable differences in radiometric response occur for the soils investigated. These variations are primarily attributed to differences in soil moisture content, particle size, and surface roughness. Particle size and surface roughness variations influence the general shape and slope of the radiometric temperature versus antenna viewing angle plots, whereas moisture content variations cause the curves to shift along the temperature axis. The dielectric properties (both real and imaginary) of soils are strongly dependant on soil moisture content. Author

N69-33673# Bureau of Public Roads, Washington, D.C.
REMOTE SENSING APPLICATIONS TO HIGHWAY ENGINEERING
Harold T. Rib *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 725–736 refs (See N69-33626 19-14)
Avail: CFSTI

The areas of possible application of remote sensors in the highway field are discussed. Several examples are included to demonstrate the value of remote sensors in various aspects of highway engineering. Also included is a discussion of the Bureau of Public Road's research program in remote sensing. Author

N69-33675# Kansas Univ., Lawrence. Dept. of Geology.
THE POTENTIAL OF RADAR IN GEOLOGICAL EXPLORATION
Louis Field Delfwig, Harold C. MacDonald, and J. Norman Kirk *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 747–763 refs (See N69-33626 19-14)
Avail: CFSTI

At the present time side-looking airborne radars (SLAR) are most useful to the geologist for regional studies of remote, previously-unmapped areas. Imaging radar systems may ultimately be most valuable for conducting regional investigations, but areas requiring detailed investigation can benefit from SLAR's unique ability to present certain types of data. Regardless of the nature of the study, dual-polarization imagery has proven the most effective in geologic investigation. In regional studies, radar should be the primary, and in some instances may be the sole sensor. The value is best demonstrated in areas where photographic coverage is not possible (or feasible) and where ground investigations are difficult or impossible. Gross structural patterns are well-displayed on SLAR imagery because of the radar's capability to continuously image wide swaths of terrain. Such a use takes maximum advantage of the relatively low resolution, which suppresses distracting and redundant detail. Author

N69-33676# Kansas Univ., Lawrence. Engineering Science Div.
RADAR SCATTEROMETER DATA ANALYSIS TECHNIQUES
R. K. Moore, W. P. Waite, J. R. Lundien, and H. W. Masenthin *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 765–780 refs (See N69-33626 19-14)
Avail: CFSTI

The use of scatterometry as a geoscience tool for discrimination and identification of terrain surfaces is discussed. The volume of data that must be interpreted in such an application makes it mandatory that a presentation technique be used that permits simultaneous scanning of multiple parameter data at a much faster rate than can be achieved with the normal scattering coefficient versus angle of incidence curves. Data from Pisgah Crater, California, are analyzed to determine the ability of the scatterometer to discriminate various surfaces. These data are shown in a variety of presentations that might be considered for use by geoscience investigators. Author

N69-33677# Geological Survey, Silver Spring, Md.
SIDELOOKING RADAR IMAGERY
Allan N. Kover *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 781–785 (See N69-33626 19-14)
Avail: CFSTI

High-resolution sidelooking radar imagery was obtained for the Earth Resources Survey Program of the National Aeronautics and Space Administration (NASA). The several images that have appeared in the scientific and popular press have evoked much interest. The published pictures represent a very small fraction of the several hundred thousand square miles imaged in 112 flight hours. There is at least token imagery in 45 States. Much of this coverage was obtained in point-to-point flying between test sites. A new source of radar imagery, a sidelooking imager installed in a NASA aircraft, is scheduled to become operational late this summer. Author

N69-33678# Geological Survey, Washington, D.C.
INFRARED SENSING OF ACTIVE GEOLOGIC PROCESSES
Jules D. Friedman and Richard S. Williams, Jr. (AFCRL) *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 787–815 (See N69-33626 19-14)
Avail: CFSTI

A specific case history of an infrared survey over an active effusive eruption at Surtsey, Iceland, is given. Infrared emission from the volcano was recorded in part concurrently by an airborne and a satellite infrared system between 19 August and 3 October, 1966. Ground and lava temperature measurements and volumetric lava outflow data allow a comparison between total thermal energy yield and radiant emission recorded by the satellite system; the Nimbus HRIR recorded radiant emission at a level of about 4% of the estimated total thermal yield. Aerial infrared imagery and derivative isoradiance maps and thermal profiles of Surtsey reveal that lava cauldron activity and incandescent lava flows in Surtur I were responsible for the major part of the radiant emission. Secondary thermal anomalies outline subsurface lava courses emanating from Surtur II, as well as fracture patterns, collapse features, pressure ridges and vent structures related to effusive flows

of 1965. The final stages in the history of Surtsey's satellite pyroclastic volcano Jólnir were recorded prior to its destruction by wave action. Author

N69-33679# National Energy Authority (Iceland).
INVITED COMMENTS
Gudmundur Palmason *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 817–825 refs (See N69-33626 19-14)
Avail: CFSTI

One obvious use of the infrared technique is a simple mapping of the surface manifestations of thermal activity. This can be used to define the areal extent of a thermal field, which is an important parameter when trying to estimate the power potential of a field prior to exploitation. This has been done for a few of the thermal areas surveyed in Iceland and has yielded more accurate estimates of surface geothermal anomalies than were available before. Besides determining the areal extent of a thermal field, airborne thermal infrared imagery also gives the configuration of the thermal anomalies in relation to tectonic features at the surface, such as faults and fissures. This information may be of value in choosing sites for drillholes in areas to be exploited. Author

N69-33680# Geological Survey, Washington, D.C.
THE STATUS OF REMOTE SENSING IN HYDROLOGY
Charles J. Robinove *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 827–831 refs (See N69-33626 19-14)
Avail: CFSTI

Remote-sensing research in hydrology, in spite of its potential large-scale application, has not kept pace with research in other fields of science. A speedup in the pace of research and the development of operational remote-sensing methods is needed. Areas of application of major importance are ground-water exploration, mapping of snow and ice, description of the dynamic physical and chemical parameters of water bodies, measurement of evaporation and transpiration, and erosion and sedimentation studies. Rigorous physical and chemical research provides the best chance for successful evaluation and development of remote-sensing techniques in hydrology. Empirical studies of available data, while of great importance in education and training, fall short of providing the rigorous quantitative methods needed by the hydrologist. Author

N69-33681# Geological Survey of Canada, Ottawa (Ontario).
EVALUATION OF AIRBORNE GAMMA-RAY SPECTROMETRY IN THE BANCROFT AND ELLIOT LAKE AREAS OF ONTARIO, CANADA
A. G. Darnley and M. Fleet *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 833–853 refs (See N69-33626 19-14)
Avail: CFSTI

Ground and airborne gamma-ray spectrometry measurements have been compared over two small areas of the Canadian Shield. The instrumentation, method of investigation, and corrections applied to the data are described briefly. The ground results are presented as radiometric contours, with intervals drawn at multiples of the area modes for potassium-40, bismuth-214 and thallium-208. Ground and airborne results are compared in profile form, and close agreement is demonstrated. Intensity of radiation from outcrop and from overburden over the same rock type has been found to be similar. The fact that total radiation intensity is dominated by the contribution from overburden does not appear to be unduly deleterious to the application of airborne gamma-ray spectrometry to geological mapping. There is evidence to suggest that radiometric "signatures" can be derived from measurements over an area and that they will be useful for identifying rock units from the air. Author

N69-33682# Texas Instruments, Inc., Dallas.
APPLICATION OF AIRBORNE GAMMA-RADIATION MEASUREMENTS TO PEDOLOGIC MAPPING
R. S. Foote *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 855–875 ref (See N69-33626 19-14)
Avail: CFSTI

An airborne system for rapidly gathering large volumes of gamma-radiation spectral data is being used to examine the uranium:thorium:potassium distribution in surface soils. These data are accumulated using six NaI(Tl) detectors 11 1/2-in. dia by 4-in. thick. Spectral counting rates for an average surface elevation of 400 ft are sufficient to allow data accumulation periods as short as 2.0 seconds followed by a 0.5-second readout of the 400 channels on magnetic tape. All results giving the magnitudes of the uranium, thorium and potassium-40-created radiation are first corrected for the spectral count contribution of the radioactive elements carried onboard the aircraft and contained in the atmosphere. These data are subsequently corrected to a constant surface elevation of 400 ft. Removal of the spectral contribution from cosmic radiation is performed during initial data reduction. Normal computer operation on the data gives isoradiation maps and radiation profile arrays for the near-surface. Author

N69-33683# HRB-Singer, Inc., State College, Pa.
DETECTION, DELINEATION, AND MONITORING OF SUBSURFACE COAL FIRES BY AERIAL INFRARED SCANNING
W. M. Knuth, W. Fisher, Jr., and R. W. Stingelin *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 877–881 ref (See N69-33626 19-14)
Avail: CFSTI

Coal mining regions have been plagued for many years by the noxious effects of subsurface coal fires which begin beneath the culm, or coal refuse piles, and often burn into abandoned underground mines. The effectiveness with which these fires can be extinguished or controlled is largely dependent upon their early detection and accurate location. Drilling techniques are currently the most widely used means of delineating subsurface fires. Aerial infrared scanning, however, has the advantages of being more economical and faster and can provide a visual synoptic record. Modification of the scanning system permits electronic differentiation of the signal and provides for manual control of the level and gain settings of the amplifier. Improved detection of thermal detail in the fire areas resulted from such modification. The images reveal significant surface radiation variations from which inferences can be drawn regarding the extent and intensity of the fires. Author

N69-33684# Minnesota Univ., Minneapolis.
REMOTE SENSORS AND GEOGRAPHICAL SCIENCE
J. R. Borchert *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 883–888 refs (See N69-33626 19-14)
Avail: CFSTI

Remote sensors are discussed in relation to what geographers are doing, what data they use and need, and the new challenges arising from their application. J.M.C.

N69-33685# Geological Survey, Washington, D.C.
REMOTE SENSING OF URBAN ENVIRONMENTS

Robert H. Alexander, Leonard W. Bowden (Calif. Univ., Riverside), Duane F. Marble (Northwestern Univ.), and Eric G. Moore (Northwestern Univ.) *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 889–911 refs (See N69-33626 19-14)
Avail: CFSTI

The tensions and strains arising from the clustering of heterogeneous population groups within urban environments of highly variable quality places the solution of these problems high among the goals of our society. Remote sensing, it is felt, can play an important role in the study of cities and the search for solutions to urban problems, and can thus become a major component in the metropolitan information systems of the future. Major tasks for future applications of urban remote sensing systems include (1) the delimitation of urbanism, and monitoring of its growth and decline, (2) the determination of urban land use and internal structure, and (3) the study of urban dynamics, including rapidly changing elements within the city and forces of the physical environment acting upon it. Recent advances in the application of photographic, thermal infrared, radar, and microwave sensors indicate that each can be used as sources of valuable data about urban environments when coupled with an appropriate information system. Author

N69-33686# Northwestern Univ., Evanston, Ill. Dept. of Geography.
UTILIZATION OF MULTIBAND AERIAL PHOTOGRAPHS IN URBAN HOUSING QUALITY STUDIES
Barry S. Wellar *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 913–926 refs (See N69-33626 19-14)
Avail: CFSTI

The collection and utilization of urban data pose problems for many scientists. Present data collection procedures are frequently expensive, slow, and subject to considerable error. The data generally do not meet the basic requirements of timeliness, flexibility, compatibility and reliability. This paper represents an initial thrust towards generating housing quality data from multiband aerial photographs which meet the above requirements. The study compares the extracted data with those used in the American Public Health Association survey appraisal form. This form is currently being examined by the U.S. Bureau of the Census as a potential basis for the 1970 Census of Housing. Author

N69-33687# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
METHODS OF FEASIBILITY AND ECONOMIC ANALYSIS OF REMOTE SENSING APPLICATIONS
Allan H. Muir (Planning Res. Corp., Wash., D.C.) and Irvin J. Sattinger *In its* Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 927–939 refs (See N69-33626 19-14)
Avail: CFSTI

Potential applications of remote sensing techniques and systems should be evaluated with respect to technical feasibility and also, if they are intended for other than scientific purposes, with respect to economic justification. To establish technical feasibility, the requirements of each application must be translated into specification of such equipment characteristics as resolution, sensitivity, and spectral discrimination, and such operational characteristics as area coverage and timeliness of the data. In addition the effectiveness of image interpretation and analysis techniques enters into the judgment of feasibility, particularly with many of the newer types of remote sensing. The economic justification of a specific project can be analyzed by determining the cost-effectiveness ratio. Author

N69-33688# National Academy of Sciences—National Research Council, Washington, D.C.
REMOTE SENSING ACTIVITIES OF COMMITTEE OF THE NATIONAL RESEARCH COUNCIL
Edward Risley *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 941–944 (See N69-33626 19-14)
Avail: CFSTI

An overview is presented on the council's activities in encouraging investigations into remote sensors and applications, from the inception of the program in 1961. The potential of remote sensing for gaining basic data about the function of the planet is mentioned, along with the need for international cooperation in such research. J.M.C.

N69-33735*# Arizona Univ., Tucson
INTERFERENCE FILTERS FOR MULTISPECTRAL PHOTOGRAPHY
D. B. McKenney and P. N. Slater 1 Aug. 1968 39 p refs
(Contract NAS9-7081)
(NASA-CR-104201; TR-25) Avail: CFSTI CSCL 14B

A new type of interference filter is described which can readily be designed for any central wavelength (400 nm to 900 nm) and any passband width (50 nm to 350 nm). These filters provide sharper cutoffs and greater efficiency than conventional absorption filters, and total transmittance in the required passbands is shown to be two or three times greater, resulting in shorter exposure times and consequently about a twofold increase in spatial resolving power for early space multiband photography experiments. Several configurations of multiband camera systems are considered, and qualitative comparisons are made regarding variation of spectral response as a function of both field of view and polarization of incident light. Author

N69-33736*# Volt Information Sciences, Inc., Washington, D.C.
EFFECT OF ADVANCE EXPOSURE ON THE SENSITIVITY OF THE UV-2T FILM TO SHORTWAVE ULTRAVIOLET RADIATION
M. R. Shpolskiy et al Greenbelt, Md. NASA. Goddard Space Flight Center 22 Jul. 1968 7 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 7, no. 3, 1969 p 441–444
(Contract NAS5-12487)
(NASA-CR-103883; ST-PHM-RAD-10858) Avail: CFSTI CSCL 14E

The influence of background exposure by electron, gamma, and visible radiation on the photographic properties of the UV-2T film used for photography in the spectral region from 2000Å to 200 Å was investigated. Prior to UV radiation exposure, the film was irradiated with an 80 keV electron beam on an electron sensitometer, with Co 60 gamma radiation, or with light on a color sensitometer with neutral grey filters of different density. The photographic properties of the film were studied in the vacuum UV region of the spectrum by means of a spectograph for radiation of the wavelengths 584 Å and 1215 Å, and in the region of the quarts UV for radiation of the wavelength 2302 Å. A high-voltage arc discharge in helium served as the UV source, a mercury lamp as a source for the quartz UV. A sensitivity increase was noted in case of prior exposure of the photolayer to radiation at wavelength 584 Å. It is suggested that a latent image formation mechanism exists in a photolayer exposed in advance. K.W.

N69-33747# North Carolina State Univ., Raleigh.
CONTINUOUS-WRITING STREAK CAMERA FOR DIFFRACTION STUDIES
J. J. Kelly and R. A. Douglas Apr. 1969 45 p refs
(Contract N00014-68-A-0187; ARPA ORDER 1080)
(AD-687416; TR-69-6) Avail: CFSTI CSCL 14/5

This report describes a high speed, continuous-writing, streak camera developed for recording time-dependent optical diffraction phenomena. The elements of the camera include an initial optical relay system, a continuous-streaking system based on a rotating optical polygon, and terminal optics in the form of a conventional camera with rectangular format that permits Polaroid use. Developed primarily for use with diffraction grating strain gages in dynamic situations where events cannot be triggered reliably with respect to time, the camera system may be of use in other situations where a continuous-writing streak capability is needed. The repetitive sweep time is variable to a minimum of 500 microsec and additional change in writing rate may be achieved easily by changing the terminal lens system. Author (TAB)

N69-33804*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STUDIES FOR THE CONSTRUCTION OF THE 100-m TELESCOPE [STUDIEN ZUR KONSTRUKTION DES 100-M-Teleskops]
O. Hachenberg 3 Jun. 1969 43 p refs Transl. into ENGLISH from Beitr. Radioastron. (Bonn), v. 1, Ser. 2, Dec. 1968
(Contract NAS7-100)
(NASA-CR-103881) Avail: CFSTI CSCL 14B

An analysis is conducted for the construction of radio astronomy telescopes and arrays. A comparison is made between the two. Reflectors and their elastic properties are examined and the limits to the use of the telescope, imposed by wind and temperature variations, are included. Author

N69-33885# Aix-Marseilles Univ. (France).
STUDY AND REALIZATION OF A NEAR ULTRAVIOLET ROCKET-BORNE SPECTROPHOTOMETER [ETUDE ET REALISATION D'UN SPECTROPHOTOMETRE SPATIAL PROCHE ULTRAVIOLET]
André Vuillemin (Ph.D. Thesis) [1969]
91 p refs In FRENCH Sponsored by CNES
Avail: CFSTI

A broad angle spectrophotometer has been designed to study both stellar and sky radiation and the performance of the instrument, composed of a diaphragm, convex mirror, grating and a Maksutov-Bouwers photographic chamber is discussed. The film calibration and photographic interpretation procedures are explained and the results from a partially successful flight are presented. Author (ESRO)

N69-33872# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
TIROS SOLAR PROTON MONITOR TEST PROCEDURES AND EQUIPMENT
Roy E. Cashion and Stephen A. Gary Jan. 1969 85 p
(Contract NOw-62-0604-c)
(AD-687456; APL-TG-1052) Avail: CFSTI CSCL 22/1

The report covers, from both design and operational standpoints, all ground test equipment provided by APL in conjunction with the TIROS Solar Proton Monitor (SPM) subsystem. This equipment consists of a Digital Decoder, A Test Suitcase, and an Auxiliary Test Unit. Complete checkout of an SPM package can be performed by means of this test equipment, either with the SPM operating independently of the spacecraft or in situ. All data from such testing is available immediately. Included in the report are complete test procedures and sample data sheets. Author (TAB)

N69-33910# Road Research Lab., Crowthorne (England).
NEW APPARATUS FOR THE MEASUREMENT AND RECORDING OF WATER LEVEL EVAPORATION AND RAINFALL
J. Prudhoe and Rutledge 1968 36 p refs
(PB-182857; RRL-LR-207) Avail: CFSTI 04B

A water level meter, evaporimeter, and raingauge have been developed for use with magnetic tape data loggers. Their descriptions and results of preliminary comparison trials against an existing water level recorder, a Meteorological Office evaporation tank and a rainfall recorder are given. Analysis shows that the results obtained from the new equipment agree closely with those obtained from the other systems. These instruments offer several advantages over existing methods of recording water level, rainfall and evaporation; the chief of these are that they record data in a form suitable for rapid automatic translation, and that they can operate for several weeks without attention. Author (USGRDR)

N69-33961*# Rice Univ., Houston, Tex. Dept. of Space Science.
A VECTOR MAGNETOMETER SYSTEM FOR DETECTION OF IONOSPHERIC CURRENTS BY SOUNDING ROCKETS
Paul A. Cloutier *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 118–132 refs (See N69-33951 19-23)
(Contract NSR-44-006-023)
Avail: CFSTI CSCL 14B

A vector magnetometer employing a scalar alkali-vapor sensor and single switchable bias coil is described. Mathematical analysis of the magnetometer signal for a spinning vehicle is performed, and the vector field comomponents in the vehicle coordinate system are extracted. Use of a vehicle aspect device is discussed, and the translation of the field vector from the vehicle coordinate system to a ground based geographic coordinate system by vehicle aspect information is performed. Electronics techniques and data reduction methods are described, and the problems of vehicle precession (coning) and time-dependent reference vectors are treated. The theoretical resolution of the magnetometer system is shown to be less than ± 1 gamma scalar magnitude, and less than ± 0.01° Author

N69-33963*# California Univ., Los Angeles.
DIGITAL OFFSET FIELD GENERATOR FOR SPACECRAFT MAGNETOMETERS
R. C. Snare and G. N. Spellman (Marshall Labs.) *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 155–166 refs (See N69-33951 19-23)
(Contracts NAS5-9570; NAS5-9098)
Avail: CFSTI CSCL 14B

A digital offset field generator has been developed which accurately extends the dynamic range of a sensitive magnetometer. This system enables the use of a sensitive magnetometer to resolve small magnetic field fluctuations in the presence of fields of large value. The circuitry is described in some detail and its application in instruments for the first Applications Technology Satellite and the fifth Orbiting Geophysical Observatory is discussed. Author

N69-33967*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STABILITY MEASUREMENTS OF FLUXGATE MAGNETOMETERS
W. I. Linlor, R. M. Munoz, and M. J. Prucha *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 198–234 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 14B

This paper has the purpose of describing stability measurements of the Ames fluxgate magnetometer particularly in regard to effects of temperature changes. A brief description will be given of the sensor for convenient reference. The associated

electronics is described. Most of the presentation will be concerned with the "offset", which can be defined as the indicated reading in a "zero" field; alternatively, it is the algebraic mean of readings along a given axis taken in the zero and 180-degree directions. Prime interest is the stability (or constancy) of the offset under systematic variation of test conditions. Both the sensor and its associated electronics may contribute to the value of the offset; variation of the parameters that affect only the sensor or only the electronics determines the relative contribution of each to the offset. Author

N69-33968*# Naval Ordnance Lab., White Oak, Md.
A HIGHLY STABLE FLUXGATE MAGNETOMETER FOR SPACE EXPLORATION
D. I. Gordon, R. H. Lundsten, R. Chiarodo, H. H. Helms, Jr. *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 235–246 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 14B

A new fluxgate magnetometer, highly stable with time and temperature, was developed. Incorporating ARC electronic circuitry for drive and detection and an NOL ring-core as the magnetometer sensor, the new magnetometer now has a zero offset level adjustable to less than 0.1 gamma, which fluctuates less than ± 0.1 gamma in 24 hours at constant temperature, and shifts less than 0.4 gamma when temperature is shifted from −30°C to +60°C. Room temperature noise is less than 0.2 gamma peak-to-peak in the frequency band of 0-10 Hz. Stability and noise measurements were made in the NOL superconducting shield as well as in the ARC flux tank. The electronics, developed by ARC, supplies fundamental drive power with negligible second harmonic content for exciting the fluxgate sensor. Core material for the highly stable sensor is NOL developed and produced 6-81 Mo Permalloy tape, which is wrapped on a one-inch diameter non-magnetic metallic bobbin, spot welded and then annealed at high temperature in a dry hydrogen atmosphere. The ring-core drive winding is toroidal while its sense and feedback windings are solenoidal. Author

N69-33969*# Naval Ordnance Lab., White Oak, Md.
A MAGNETOMETER TEST ENVIRONMENT USING AN EXPANDABLE SUPERCONDUCTING ENCLOSURE
R. E. Brown *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 247–257 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 14B

A volume containing a reduced magnetic field may be obtained inside a lead foil sack by opening the folded sack at 4.2°K when the lead is superconducting. A multi-stage magnetic flux vacuum pump based upon this idea was used to reduce earth's field to below 10^{-6} oersted in a volume of several cubic inches. The superconducting sack shields this volume against the magnetic field fluctuations of the laboratory environment. The estimated noise level in the low field space is 10^{-9} oersted. A glass dewar inserted into the sack permits working in the low field space at controlled temperatures near room temperature. This system has had extensive use for the study of the long term stability of flux-gate magnetometer sensors destined for use in space exploration. Author

N69-33972*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
A MAGNETICALLY SHIELDED CHAMBER USED IN SIMULATING SPACE ENVIRONMENT
J. Dale Barry, Paul J. Coleman, Jr., Uri Fehr, and Larry L. Simmons *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 290–307 ref (See N69-33951 19-23)
(Grant NsG-237-62)
Avail: CFSTI CSCL 14B

A walk-in, magnetically shielded chamber used in the testing and calibration of sensitive space-flight magnetometers is discussed. The chamber is a two-shield cubical design, using a highly permeable, annealed shielding material. The facility includes a large three-dimensional coil array surrounding the chamber and a small, calibrated, double Helmholtz coil array at the geometrical center of the chamber. Within the Helmholtz coils is a non-magnetic temperature chamber in which a magnetometer sensor can be subjected to variations in the ambient temperature of −50°C to +100°C. A non-magnetic fixture used for 3600 rotation of a magnetometer sensor is placed within the temperature chamber. In addition, the magnetically shielded chamber is situated upon a non-magnetic table which allows 360° rotation of the complete facility. Author

N69-33981# Liège Univ. (Belgium). Institut d'Astrophysique.
DESCRIPTION OF AN ONBOARD SPECTROGRAPH FOR THE SPECTROSCOPIC OBSERVATION ON FILM OF AURORAL SPECTRA [DESCRIPTION D'UN SPECTROGRAPHE EMBARQUABLE POUR L'OBSERVATION SPECTROSCOPIQUE SUR FILM D'AURORES BOREALES]
J. M. Vreux Paris ESRO Jul. 1968 40 p refs In FRENCH; ENGLISH summary
(ESRO-SM-75) Avail: CFSTI

The aim of experiment C-52 is to obtain a photographic record of an auroral spectrum in the far ultraviolet and also a simultaneous recording of lines 5577 (O I) and 3914 (N_2^+) by means of two separate photometers. The conditions under which a launching may usefully take place are discussed and it is concluded that the rocket should be fired at the time of an IBC 3. The possibility of making simultaneous observations on the ground with an identical spectrometer is briefly discussed. Author (ESRO)

N69-33988# Kernforschungszentrum, Karlsruhe (West Germany).
THE ACCURACY OF PERSONNEL DOSIMETER READINGS: A CRITICAL REVIEW OF INTERCOMPARISON MEASUREMENTS
E. Piesch Dec. 1968 27 p refs
(KFK-825) Avail: AEC Depository Libraries

The results of intercomparison test exposures with film, TLD, and RPL dosimeters are reviewed. To discuss the measuring accuracy attainable today by routine personnel dosimeters the measuring accuracy will be described exactly by the distribution curve of the dose reading deviations related to the actual dose. Instead of the term standard deviation normally used, two different values are ascertained here to compare the results of different test exposures: the relative number of exposures found within a dose reading deviation of ± 30% and the dose reading deviation found for 85% of all test irradiations (15% outliers). A careful examination of the results of 12 intercomparison test exposures so far published in the United States, the United Kingdom and Germany demonstrates that the film dosimeter, most frequently used in routine monitoring today, has an unfavourable measuring accuracy. Author (NSA)

N69-34004# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Fluid Dynamics Facilities Research Lab.
SOME COMMENTS ON THE EFFECT OF GAGE LENGTH IN DYNAMIC STRAIN MEASUREMENT Final Report
Marion G. Pottinger Jan. 1969 53 p refs
(AD-687864; ARL-69-0014) Avail: CFSTI CSCL 14/2

The effect of strain gage length on the transducing of common pulses and continuous sinusoids is summarized. A graphical method for approximating the response to a general pulse is presented. Author (TAB)

N69-34023# European Space Research and Technology Center, Noordwijk (Netherlands).
DEVELOPMENT OF AN AUTOMATIC SYSTEM OF MASS SPECTROMETRIC ANALYSIS
J. Dauphin, M. Ladous, and R. F. Worron Paris ESRO Dec. 1968 36 p refs Presented at the GAMS Congr., Paris, 30 Sep.–4 Oct. 1968
(ESRO-TN-36-ESTEC) Avail: CFSTI

Materials used in the construction of spacecraft are exposed to an extreme environment, the main components of which (high vacuum, ultra-violet and particle radiation) can cause degradation. Mass spectrometry is used to analyse the degradation products. These are generally complex mixtures of low-molecular weight organic or mineral compounds. The analysis, which is both qualitative and quantitative, is performed by computer by a multiple regression method (MSCOMP programme of Shell, California) based on a library of standard spectra (MSRLIB programme of Shell, California). ESTEC has a THN 206 (Thomson-Houston) spectrometer equipped with a THN 211-02 digitisation unit which, in conjunction with a tape punch, produces coded tapes containing spectral intensity and mass values. The present paper is concerned with the technical problems of automatic adaption of the data format supplied by the digitisation system to the input norms of the MSCOMP and MSRLIB programmes, and correction of the digital data carried on punched tape. A transfer programme is currently being developed to perform the following functions: linearisation of the mass scale, automatic calibration relative to a standard spectrum, extraction of background peaks (MSRLIB only), multiplet grouping, data formatting, spectrum print-out in standard form (API). This transfer programme has not yet been finalised, but preliminary results are satisfactory. Author (ESRO)

N69-34039# Commissariat a l'Energie Atomique, Saclay (France). Centre d Etudes Nucleaires.
NUCLEAR DETECTORS: PHOTOMULTIPLIERS, COUNTERS, IONIZATION CHAMBERS [DETECTEURS NUCLEAIRES: PHOTOMULTIPLICATEURS, COMPTEURS, CHAMBRES D IONISATION]
Andre Roguin and Jacky Weill May 1968 15 p refs In FRENCH Presented at the Reunion Intern. Electron. et I Automatisme, HERCEG NOVI, 24 Apr. 1968
(CEA-CONF-1232; CONF-680842-7) Avail: AEC Depository Libraries

An account is given of recent work on nuclear detectors other than semiconductor detectors. This review allows one to determine the recent possibilities of these types of detectors and gives a survey of future development. Nuetron–electron converters, counters with a boron deposit, recoil proton counters, fission chambers, G–M and proportional counters and photomultipliers are described. Author (NSA)

N69-34074# United Kingdom Atomic Energy Authority, Harwell (England).
AUTOMATIC CALIBRATION OF RADIATION MONITORING FILMS
P. D. Holt Mar. 1969 15 p ref
(AERE-R-6037) Avail: CFSTI

A jig is described for exposing calibration films (or thermoluminescent dosimeters) to known doses of gamma radiation. Films are exposed in two perpendicular planes to enable the maximum number to be exposed at one time. The source is cylindrical and is exposed horizontally by a pneumatic method which enables automatic timing to be incorporated. The source exposure system works well, and the uniformity of dose at any one distance from the source is sufficient provided not more than four films at the same dose level are required from one exposure. The jig is in routine use at Harwell. Author (NSA)

N69-34080# Atomic Weapons Research Establishment, Aldermaston (England).
HOLOGRAPHIC MEASUREMENTS OF VIBRATION AMPLITUDES USING POWELL AND STETSON FRINGES
M. R. Wall Sep. 1968 20 p refs
(AWRE-O-72/68) Avail: CFSTI; HMSO 4s 6d

Preliminary results demonstrated the validity of a zero-order Bessel function fringe shape for holographic sinusoidal vibration fringes. Accurate measurements of the shape of a simple vibrating strip are described. A technique is illustrated for extending the visibility of fringe systems and of maximum useful vibration amplitude capability. Author (NSA)

N69-34083# Commissariat à l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucléaires.
STUDY AND ACHIEVEMENT OF A DIGITAL-ANALOG DIVIDER [ETUDE ET REALISATION D'UN DIVISEUR ANALOGIQUE NUMERIQUE]
André Pétin (Ph.D. Thesis–Conservatoire Natl. des Arts et Métiers) Apr. 1969 112 p refs In FRENCH; ENGLISH summary
(CEA-R-3648) Avail: CFSTI

This apparatus is designed to give directly, in digital form, the value of the ratio V_1/V_2 of two analog voltages. It consists essentially of an analog-digital coder operating by successive weighings in which the comparison voltage is made proportional to the divider V_2 in the coder. The input dynamics are such that the voltages V_1 and V_2 are all in the range −50 mV to −5 V. Each of the circuits has an input impedance of about 10 KΩ. The quotient is a binary number given in series and parallel form; it is composed of 8 bits, thus giving a variation of 1/16 to 16 per jump of 1/16 in the zone where the accuracy is highest ($V_2 \geq 800$ mV). The time required for a division is, at best, 15 μsec. During the time of calculation, the voltages V_1 and V_2 should not vary by more than 1 per cent and 0.5 per cent respectively. The theory of the system and the investigation of a synoptic diagram, the study of the circuits and the actual construction are all discussed. Author (ESRO)

N69-34088# California Univ., Livermore. Lawrence Radiation Lab.
DETERMINING RELATIVE RESOLTUION ON A SENSITOMETRIC STEP WEDGE
Michael Milochik 2 Jan. 1969 9 p
(UCRL-50565) Avail: CFSTI

A simple and quick method, developed for determining the relative resolution of a film/developer combination as a function of exposure, is described. The film being tested sees a target containing 21 three-line sets of 0.5-, 1-, and 3-mil lines against a 21-step sensitometric wedge. Evaluating films with this setup enables one to do routine sensitometry, granularity study, and resolution study all on one film sample. Author (NSA)

N69-34109# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
TIME FLUCTUATIONS IN THE RESPONSE OF PHOTOMULTIPLIER TUBES DARIO 56 AVP, XP 1021, XP 1210 [FLUCTUATIONS TEMPORELLES DE LA REPONSE DES PHOTOMULTIPLICATEURS DARIO 56 AVP, XP 1021, XP 1210]
Gérard Breuze and Pierre Sawins May 1969 43 p refs In FRENCH; ENGLISH summary Presented at the Inter. Colloq. on Nucl. Electron., Versailles, France, 10–13 Sep. 1968
(CEA-R-3802) Avail: CFSTI

The intrinsic time resolving power of 3 photomultiplier tubes, Dario 56 AVP, XP 1021, XP 1210 at various excitation levels, has been studied using short light pulses. It is shown, in agreement

with theory that there is an optimal resolving power for a certain trigger threshold, and the law governing the variation of this resolving power with the average number of photo-electrons emitted has been verified. The results show the progress made by the manufacturer between the 56 AVP and the XP 1210 models, e.g. with 100 photoelectrons per pulse, the times of resolution are 280 $\times 10^{-12}$ s and 75 $\times 10^{-12}$ s respectively and the rise time for the anode pulses decreases from 2.3 to 1.2 $\times 10^{-9}$ s. The intermediate tube, XP 1021, also has a good performance with respect to the 56 AVP. The difficulties encountered in making accurate measurements of fasttime characteristics of photomultipliers as fast as XP 1210, and the limitations imposed by the light source are stressed. Author (ESRO)

N69-34126# Los Alamos Scientific Lab., N.Mex.
HIGH EFFICIENCY NEUTRON DETECTORS FOR NUCLEAR SAFEGUARDS APPLICATIONS
L. V. East and R. B. Walton [1969] 5 p
(Contract W-7405-eng-36)
(LA-DC-9761; CONF-681101-20) Avail: CFSTI

Two designs of polyethylene-moderated neutron detectors utilizing multiple helium-3 proportional counters with matched responses are described. NSA

N69-34176# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
CALIBRATION OF STANDARD LEAKS USING AN ANALYTICAL GAS MASS SPECTROMETER
T. M. Mason 18 Feb. 1969 11 p
(Contract AT(29-2)-656)
(GEPP-61) Avail: CFSTI

An analytical gas mass spectrometric method of calibrating standard leaks is discussed. This method has an estimated ±5 percent accuracy, the calibration can be completed in one day, and it has the capability of measuring active gases and distinguishing between gases in the system. Author (NSA)

N69-34209# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
A 4 PION BETA-GAMMA COINCIDENCE COUNTER FOR THE ABSOLUTE STANDARDISATION OF RADIOACTIVE FOILS AND ITS USE IN THE RECALIBRATION OF THE BNL STANDARD THERMAL NEUTRON FLUX
I. M. G. Thompson Aug. 1968 18 p refs
(RD/B/N1116) Avail: CFSTI

Details of a 4π beta gamma coincidence apparatus are given. A recalibration of the Berkeley Nuclear Laboratories standard thermal neutron flux using the apparatus is described. This shows that the correction factors applicable to this technique are very much smaller than those of the 4π beta counting method. The flux density below cadmium cut-off was estimated to be 1.87 $\times 10^4 cm.^{-2} sec.^{-1}$. An independent measurement of the flux agreed to within 0.4 percent with this value. Author

N69-34295# Utah State Univ., Logan. Electro-Dynamics Labs.
ELECTRONIC RAPID-SCANNING SPECTROMETER Final Report, 1 Feb. 1965–31 Jul. 1968
Allen J. Steed, John C. Kemp, and Doran J. Baker 31 Jul. 1969 68 p refs
(Contract AF 19(628)-4994)
(AD-687739; AFCRL-68-0597) Avail: CFSTI CSCL 20/6

An all-electronic scanning spectrometer system is described which scans the 0.6 to 1 micron spectral region at scanning rates of 10,200 and 1,020 scans/second with provision for automatic switching from the faster to the slower scanning rate. An image dissector photoelectron multiplier tube is used as the detector. The system is designed for operation in a KC-135 aircraft. A data recording and recovery system is included which enables recording of high-frequency data with readout at lower frequencies without loss of high-frequency information. A scan identification system identifies the relative data acquisition time for each scan. A system calibration is included. Author (TAB)

N69-34307# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF NEUTRON SPECTROMETRY FOR CRITICAL FACILITIES Quarterly Report, 1 Jan.–31 Mar. 1969
R. A. Semmler Apr. 1969 21 p refs
(Contract AT(11-1)-578)
(IITRI-578-P-33-6; QR-2) Avail: CFSTI

The development of a wall-less proportional counter for neutron spectometry is described. Work on computer codes for data reduction and work on the detector head itself are discussed. Work on refurbishing the detector was completed and testing was started. Wire failures during the test period, however, have resulted in about 50% downtime for repairs. A revised test schedule is presented as well as the data collected for the following areas: breakdown voltage, ion drift time, calculated and measured resolution, field tube voltage, proportional operation tests, and schemes for combining the wall-less counter technique with pulse shape discrimination. A computer program to convert idealized proton recoil spectra to neutron spectra has been adapted for local use from a code developed at Argonne National Laboratory. Author (NSA)

N69-34331# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.
OPTICAL DENSITY MEASUREMENT BY A NULL-METHOD FOR AN AUTOMATIC DENSITOMETER
J. B. Rae Dec. 1968 13 p refs
(AERE-R-5929) Avail: CFSTI; UK 2s 6d

A split beam optical densitometer is described for use in an automatic machine to assess photographic film radiation exposure. A close approximation to British Standard Diffuse Density is measured over the range 0 to 3 with an accuracy of 0.005 density units. Author (NSA)

N69-34392# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
INSTRUMENTATION FOR ANALYSIS OF THE INERT GASES USED IN FFTF
G. B. Barton Mar. 1969 56 p refs
(Contract AT(45-1)-1830)
(BNWL-957) Avail: CFSTI

Inert gas monitoring needs of the FFTF are reviewed. The selection criteria for the required instrumentation is defined. Current technology and commercially available on-line gas analytical instrumentation are reviewed and compared to FFTF requirements. Results conclude that FFTF cell blanket gas analytical needs can be met in almost all instances by commercially available instrumentation. Current technology is inadequate to meet Na cover gas monitoring needs and a development effort is required. Gas chromatography and possibly mass spectrometry appear to hold the greatest promise of meeting Na cover gas monitoring needs. Author (NSA)

N69-34402# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
PRELIMINARY INVESTIGATIONS INTO MEASUREMENT OF BETA DOSE WITH AN EXTRAPOLATION CHAMBER, AND THE ASSESSMENT OF THE BETA RESPONSE OF BETA-GAMMA SURVEY INSTRUMENTS

I. M. G. Thompson, R. J. Boylan and J. Goodwin Jul. 1968 29 p refs
(RD/B/N1117) Avail: CFSTI

An extrapolation ionization chamber has been used to measure the dose distribution above a number of beta emitting sources having different spectra. These sources have been used to examine the beta response of commercial beta sensitive gamma survey instruments. Author

N69-34434# Tracerlab, Inc., Richmond, Calif.
GAMMA DETECTING-INDICATING SYSTEM AN/GKQ-4 Technical Report, Apr. 1963-Jun. 1967
Ivan Sturman Kirtland AFB, N.Mex. AF Weapons Lab. Mar. 1969 68 p
(Contract AF 29(601)-5995)
(AD-687868; AFWL-TR-68-97) Avail: CFSTI CSCL 18/4

The AN/GKQ-4 consists of a set of devices for monitoring gamma radiation intensity from as many as 10 remote detectors located as far as 10 miles line-of-sight from a central control and readout station. Either of two modes of data transmission, radio or land line, may be used. A voice communication capability is available between the remote detectors and the central station. This is used during installation, checkout and maintenance. The present design and frequency allocation for the radio telemetry limit the distance of the remote stations to approximately 10 miles line-of-sight. Each remote detector consists of a rugged enclosure, ion chamber detector, control module, command receiver, telemetry transmitter, power supply, a rechargeable battery, and an antenna. Author (TAB)

N69-34441# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
SUMMARY OF THE DESIGN OF A MAGNET SUSPENSION AND BALANCE SYSTEM FOR THE AEROSPACE RESEARCH LABORATORIES
Timothy Stephens Wright-Patterson AFB, Ohio ARL Jan. 1969 81 p refs
(Contract AF 33(615)-1470)
(AD-687867; ARL-69-0019; TR-140) Avail: CFSTI CSCL 14/2

The design of a six-component magnetic suspension and balance system for use in wind tunnels is summarized. The general features of the magnet system, model-position sensing system, compensation system, and power amplifiers are described. The auxiliary equipment required for magnet cooling and safe operation of the balance is outlined. Author (TAB)

N69-34488# United Kingdom Atomic Energy Authority, Harwell England. Atomic Energy Research Establishment.
BETA-GAMMA COUNTING SYSTEM FOR 2000 SERIES
K. Witsey Dec. 1968 29 p *ref*
(AERE-M-1838) Avail: CFSTI; UK 5s 0d

A system is described for coupling G.M. detectors into the 2000 Series unitized system, comprising a head unit which is mounted close to the detector, used in conjunction with one of two adaptors. The head unit generates a fast quench pulse (2.5 volts/nanosecond) and is mounted close to the detector to minimize stray capacitance. High voltage supplies for the detector and the head unit are provided by the adaptors. A system for low background beta-gamma counting using a Van Duuren anticoincidence detector is also described. Author (NSA)

N69-34500# General Electric Co., Schenectady, N.Y. Research and Development Center.
THREE-DIMENSIONAL QUADRUPOLE ION TRAP MASS SPECTROMETER Final Report, 1 Apr. 1968-30 Apr. 1969
Peter H. Dawson and N. Rey Whetten Apr. 1969 25 p refs
(Contract F19628-68-C-0261)
(AD-688621; S-69-1087; AFCRL-69-0185) Avail: CFSTI CSCL 14/2

Two mass spectrometers of the three-dimensional quadrupole type were constructed, along with the associated electronics. The electrodes of the mass spectrometers were accurately machined from stainless steel to the shape of hyperboloids of revolution. The mass range is from 1 to 75 atomic mass units. Heavier masses can be stored in the spectrometer, but cannot be easily mass-analyzed with the present electronics. The ion storage properties of these units are extremely good. Ions were stored in the mass spectrometer for days at low pressures. An interesting property was observed that may be useful in ion storage experiments. The presence of a neutral light gas, such as helium, was found to make heavier ions much more stable. The ion densities that can be stored in the spectrometer were found to be somewhat higher than had originally been expected. A new phenomenon discovered in this work (self-ejection of ions due to ion plasma resonances) enabled an independent density determination to be obtained. Author (TAB)

N69-34524# California Univ., Livermore. Lawrence Radiation Lab.
DESIGN OF GAMMA-GAMMA METHOD PROBES FOR MEASUREMENTS WITH A VARYING DISTANCE TO THE SURFACE OF THE INVESTIGATED MEDIUM
Yu. I. Kudryavtsev Mar. 1969 17 p refs Transl. into ENGLISH from Vestn. Leningrad. Univ., Ser. Geol. Geogr. (USSR), v. 22, no. 18, 1967 p 76-83
(UCRL-Trans-10333) Avail: AEC Depository Libraries

The geometrical characteristics of GGM probes working at various distances from the surface of the medium have been investigated theoretically. Formulas are given to determine the optimum parameters of probes in which the intensity of the characteristic and singly-scattered radiation is practically independent of the distance (air gap) between the probe casing and the surface under investigation. Author (NSA)

N69-34551# Association Francaise pour l'Etude et le Développement des Applications de l'Energie Solaire, Paris.
SOLAR RADIATION MEASUREMENT AND RADIATIVE HEAT TRANSFER [MESURE DU RAYONNEMENT SOLAIRE ET DES ECHANGES RADIATIFS]
1968 125 p In FRENCH Proc. of a Meeting of the Soc. Franc. des Thermiciens, Paris, 25 Jan. 1968
Avail: CFSTI

CONTENTS:

1. GENERALITIES ON SOLAR AND TERRESTRIAL RADIATIONS C. P. de Brichambaut (France. Fir. de la Meteorologie Natl.) 9 p (See N69-34552 19-29)

2. SPECTROMETRIC METHODS FOR MEASURING RADIATION M. F. Cabannes (Centre Natl. la Recherche Sci.) 28 p (See N69-34553 19-29)

3. RADIATION DETECTORS AND THE MEASUREMENT OF THEIR CHARACTERISTICS F. Desvignes (Lab. d Elect. et de Phy. Appl.) 59 p (See N69-34553 19-14)

4. CURRENT INSTRUMENTS FOR RADIOMETRICAL MEASUREMENTS G. Lamboley (France. Dir. de la Meteorologie Natl.) 22 p (See N69-34555 19-14)

N69-34554# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
RADIATION DETECTORS AND THE MEASUREMENT OF THEIR CHARACTERISTICS [LES CAPTEURS DE RAYONNEMENT ET LA MESURE DE LEURS CARACTERISTIQUES]

F. Desvignes *In* Assoc. Franc. Etude et Develop. Appl. Energie Solaire Solar Radiation Meas. and Radiative Heat Transfer 1968 59 p In FRENCH (See N69-34551 19-14)
Avail: CFSTI

Photoelectric properties of radiation detectors are summarized and detectors are listed as either thermal and energy detectors or quantum detectors. Measuring methods for the evaluation of the photoelectric properties of radiation detectors are discussed. The results are applied to natural radiation simulation and as an example the measurement of the sensitivity and energy efficiency of photopiles for solar energy conversion are analyzed. ESRO

N69-34555# France. Direction de la Meteorologie Nationale, Paris.
CURRENT INSTRUMENTS FOR RADIOMETRICAL MEASUREMENTS [INSTRUMENTS DE RADIOMETRIE COURANTE]
G. Lamboley *In* Assoc. Franc. Etude et Develop. Appl. Energie Solaire Solar Radiation Meas. and Radiative Heat Transfer 1968 22 p In FRENCH (See N69-34551 19-14)
Avail: CFSTI

Descriptions, calibrations and measurement methods of pyrheliometers measuring direct solar radiation, pyranometers measuring global, solar or sky radiation and pyrradiometers measuring solar and terrestrial radiation together are discussed in some detail. ESRO

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-33258*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTS ON THE STEADY STATE CHARACTERISTICS OF HERRINGBONE-GROOVED AIR-LUBRICATED JOURNAL BEARINGS
Robert E. Cunningham, David P. Fleming, and William J. Anderson Washington Aug. 1969 28 p refs
(NASA-TN-D-5386) Avail: CFSTI CSCL 13I

Experiments were conducted with five rotors 3.81 cm in diameter and equipped with two herringbone-grooved patterns. Results showed that a range of groove- to ridge-clearance ratios of 2.0 to 2.4 has greater load capacities than do ratios greater or less than this optimum range. Load capacity increases with eccentricity ratio at a rate greater than linear. Agreement with a small-eccentricity pressure perturbation theory was good for groove- to ridge-clearance ratios in this optimum range but only at eccentricity ratios less an 0.3. These rotors were operated under unidirectional loading to a maximum compressibility number of 45. Author

N69-33281*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR VISCOUS, ISOTHERMAL COMPRESSIBLE FLOW ACROSS A SEALING DAM WITH SMALL TILT ANGLE
John Zuk and Patricia J. Smith Washington Aug. 1969 89 p refs
(NASA-TN-D-5373) Avail: CFSTI CSCL 13I

An analysis of the flow across a sealing dam of the type that appears in gas turbine seals was developed for steady, laminar, subsonic, isothermal compressible flow. The analysis is valid for both parallel sealing dam surfaces and surfaces separated by a small tilt angle. The computer program determines mass flow rate, pressure and velocity distributions, Mach number, force, center of pressure, axial film stiffness rotational flow and pressure flow Reynolds numbers, power loss, and approximate temperature rise resulting from viscous shearing. The output is in both English units and the International System of Units. Some of the results can be automatically plotted. Author

N69-33373*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND APPARATUS FOR MAGNETOMOTIVE PRECISION SIZING AND JOINING OF LARGE DIAMETER TUBES
Robert J. Schwinghamer, inventor (to NASA) and J. D. Bennight, inventor (to NASA) Filed 27 Jun. 1969 29 p
(NASA-Case-5114-2; US-Patent-Appl-SN-837377) Avail: CFSTI CSCL 13I

An apparatus has been developed for portable high-precision magnetomotive bulging, constricting, and joining of metal tubes. The method allows decremental, accurate changing of the diameter of large, thin-walled tubes without heating, as well as high-quality joints obtained by either bulging or constricting overlapping ends of two tubes. The apparatus consists of a magnetomotive coil positioned either inside or outside of the tube and a non-conducting mandrel (or forming die) on the other side. The magnetomotive coil has square conductors which are recessed, and thus separated by an air gap, from the tube. The coil has a split metal sleeve for withstanding hoop stress. The tube (workpiece) is insulated from the coil by a thin plastic sleeve. The power supply is an electrically floating system. NASA

N69-33439*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DEVELOPMENT AND DEMONSTRATION OF CRITERIA FOR LIQUID FLUORINE FEED SYSTEM COMPONENTS
D. L. Endicott and L. H. Donahue Jun. 1969 294 p refs
(Contract NAS3-11195)
(NASA-CR-72543; DAC-63240) Avail: CFSTI CSCL 13I

A five-part program was completed to supplement the design criteria of flight-weight fluorine feed systems development. The five parts of the program included the following: (1) conceptual design studies of 2-in. shutoff valves and vent-relief valves with special emphasis on a poppet type shutoff valve; (2) studies of contaminents in LF_2 systems with emphasis on potential hazards of water-ice in liquid fluorine; (3) material compatibility tests on titanium Ti-5Al-2. 5Sn (ELI) alloy and thin TFE coatings; (4) filter compatibility tests to evaluate filter elements of high purity nickel and Al_2O_3 materials in full-size fluorine filters; and (5) compatibility tests on various types of explosively actuated valves in both liquid and gaseous fluorine. Author

N69-33480*# Pratt and Whitney Aircraft, East Hartford, Conn.
DESIGN OF BRAYTON ROTATING UNIT ON ROLLING-ELEMENT BEARINGS
R. Cohen and J. Clausi Washington NASA Aug 1969 98 p
(Contract NAS3-10949)
(NASA-CR-1401; PWA-3549) Avail: CFSTI CSCL 13I

The National Aeronautics and Space Administration is developing a Brayton-cycle space power system as part of its evaluation of potential long-life nuclear and solar electrical power sources. The candidate Brayton-cycle system under active investigation incorporates a single-shaft rotating unit consisting of a compressor, turbine and alternator rotating on gas bearings. This study was conducted to design such a Brayton rotating unit operating on oil-lubricated rolling-element bearings. Design of the bearing system was based on the technology demonstrated in two 2500-hour endurance tests successfully conducted in previous programs. Therefore, the bearing system design should be capable of development for mission lifetimes in excess of 10,000 hours with no significant oil contamination of the power system. Author

N69-33484*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SELF-LUBRICATING GEARS AND OTHER ROTATING PARTS
Keith E. Demorset, inventor (to NASA) Filed 26 May 1969 12 p (NASA-Case-MFS-14971; US-Patent-Appl-SN-827579) Avail: CFSTI CSCL 13I

Gears and other mechanical parts having surfaces adapted to engage in frictional contact are constructed of alternating layers of metal and a dry-lubricant-containing material bonded into a laminated composite body. The lubricating layers extend through the body of the part so that exposed portions thereof form a part of the contacting surfaces. Disposition of the lubricating layers diagonally with respect to contacting surfaces provides for continuous distribution of a lubricating film by lateral movement of the exposed lubricating portion over the opposing surface with rotation of the part. NASA

N69-33774# Institute of Technology, Helsinki (Finland).
THE ROLE OF END TEMPERATURE IN THE RESISTANCE WELDING OF CARBON STEELS
E. K. Ihalainen and H. M. Miekk-Oja 1968 21 p refs *Its* Acta Polytech. Scand., Chem. Met. Ser. 80
(PB-182953; APS-CH-80) Avail: CFSTI CSCL 13H

The influence of the end temperature of welding on the quality of a resistance welded joint was studied microscopically and by means of mechanical tests in carbon steels with carbon contents from 0.16% to 1.06%. Author (USGRDR)

N69-33790# Naval Research Lab., Washington, D.C.
MECHANICAL CONSIDERATIONS IN FRACTURE CHARACTERIZATION OF NARROW GAP WELDMENTS Interim Report
C. N. Freed and P. P. Puzak Apr. 1969 17 p refs
(AD-687402; NRL-6877) Avail: CFSTI CSCL 13/5

The Dynamic Tear (DT) test provides a reliable measurement of fracture toughness under limit severity mechanical conditions. In this investigation, the DT test was used to characterize the fracture toughness for a weldment of 2-in.-thick A-543 plate prepared by the automatic Narrow-Gap (N-G) welding process. The DT test specimen was modified through the use of side grooves. Fracture toughness of the weld metal was found to be dependent upon welding position; the flat (1200) and near vertical (0200) weld positions produce high upper shelf energy values equivalent to that of the plate metal, while the 0400 (near vertical) and 0600 (overhead) positions indicate a shelf level toughness approximately one-half that of the plate. Results of 5/8-in. DT tests were consistent with values from full-thickness, 2-in. DT specimens. The C sub v test produced a misleading indication of the transition temperature range and the temperature at which the upper shelf, full ductility develops. The uniquely limited width of the N-G weld enhanced the fracture toughness of the weldment in the transition temperature range and on the upper shelf when the crack tip plastic zone size exceeded the weld zone and entered the A-543 plate. This increased the resistance to fracture propagation through involvement of the tough plate metal. Author (TAB)

N69-33800*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF A WELD QUALITY MONITOR
J. G. Etzel and J. A. Munford Washington Aug. 1969 11 p refs
(NASA-TN-D-5304) Avail: CFSTI CSCL 13I

Development of a nondestructive method of evaluating crosswire resistance welded joints used in electronic packaging is discussed. Mechanical strength and reproducibility of strength were determined for several alloy combinations. Data indicated that an optimum degree of embedment exists for each combination of materials. This report describes the development of an electromechanical device that automatically measures and displays the embedment of each welded joint and locks out the welding machine if the embedment value is not within preset upper and lower limits. Author

N69-33853# Purdue Univ., Lafayette, Ind. Thermalphysical Properties Research Center.
BIBLIOGRAPHY ON THERMAL CONTACT CONDUCTANCE
C. K. Hsieh and F. E. Davis Wright-Patterson AFB, Ohio AFML Mar. 1969 44 p refs Supported by AF
(AD-687474; AFML-TR-69-24) Avail: CFSTI CSCL 13/5

The report contains a comprehensive bibliographic listing of 423 research papers covering theoretical and experimental work on thermal contact conductance for the period prior to 1966. Each of the papers have been classified into ten subject areas: thermal contact, electrical contact, surface finish, contact physics, theory, experiment, survey, discussion, correlation, and bibliography. Author (TAB)

N69-33950# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
POSSIBILITIES FOR MARKING THE OPTICAL APPEARANCE OF PRINTED COLORS BY NUMERICALLY CODED COLOR SYSTEMS OR BY STANDARDIZED COLOR MEASUREMENT VALUES [MOEGLICHKEITEN ZUR KENNZEICHNUNG DER OPTISCHEN ERSCHEINUNG VON DRUCKFARBEN DURCH DIE FARBMASSZAHLEN VON FARBSYSTEMEN ODER DIE NORMFARBWERTE DER FARBMESSUNG]
Helmut Uhrig *In its* Rept. in Cartography and Geodesy. Ser. 1: Ger. Contrib. and Inform., No. 34 1967 p 91-99 refs (See N69-33945 19-13)
Avail: CFSTI

The emphasis in this study is on two major systems for the standardization of colors, namely the Munsell system and the German DIN system. The mathematical relationship and problems in the conversion from one system to the other are briefly examined. The classification of colors according to hue, value, and chroma is defined. Existing international standards are also mentioned. Transl. by K.W.

N69-34101# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF A PROCESS FOR PNEUMATIC EXTRUSION OF METALS Final Report, 1 Dec. 1966-1 Feb. 1969

L. A. Filayson, C. K. Cole, and R. H. Cornish Watertown, Mass. Army Mater. and Mech. Res. Center 1 Feb. 1969 296 p
(Contract DA-19-066-AMC-307(X))
(AD-687330; AMMRC-CR-68-04(F)) Avail: CFSTI CSCL 13/8

Pneumatic extrusion of metals by means of high pressure nitrogen gas was demonstrated. The advantages of pneumatic extrusion over hydrostatic extrusion are: (1) a more uniform extrusion force, (2) faster extrusion rates, (3) elimination of high pressure combustible vapor, (4) the ability to maintain a cold vessel wall during elevated temperature extrusion. Both pneumatic and hydrostatic extrusion result in a considerable reduction in die friction when compared to conventional mechanical extrusion; indeed at extrusion pressures above 70,000 psi essentially equivalent frictional characteristics exist in the two fluid extrusion systems. Pneumatic extrusion does pose difficulties in extrusion catching and blast shielding. A study is described wherein pneumatic extrusion was used for the extrusion of aluminum and mild steel at pressures to 140,000 psi. Author (TAB)

N69-34207# Pisa Univ. (Italy). Istituto per l'Elaborazione Dell'Informazione.
THE FORMAL DEFINITION OF MACHINE TOOL LANGUAGES
Alfonso Caracciolo Di Forino May 1969 29 p refs To be presented at IFIP-IFAC Prolamat. Conf., Rome, 15–17 Sep. 1969
(Contract F61052-67-C-0097)
(AD-688603; AFOSR-69-1396TR) Avail: CFSTI CSCL 13/8

A rough model for machine tool languages is used for clarifying basic concepts. The model describes an MT language by a recursive function that yields, for each input tape, initial state and initial workpiece configuration, the final state and the final workpiece configuration. Author (TAB)

N69-34242# Army Natick Labs., Mass. Airdrop Engineering Lab.
MODULAR HONEYCOMB CONCEPT FOR PREPARATION OF LOADS FOR DELIVERY BY AIRDROP
James F. Falcone Mar. 1969 38 p refs
(AD-688582; USANLABS-TR-69-63-AD) Avail: CFSTI CSCL 13/4

Current studies aimed at simplification of the preparation of loads for delivery by airdrop have resulted in a concept for a simplified method of preparing the honeycomb cushioning system. This concept employs a small number of standard size honeycomb modules which can be used as building blocks to construct the many different sized stacks employed in current rigging procedures. Analysis and limited testing indicate that it would be feasible to use five standard size modules of honeycomb to rig practically all airdrop loads. Author (TAB)

N69-34288# Miller Trailers, Inc., Bradenton, Fla. Military Electronic Div.
M4 EXPANSIBLE VAN BODY PHYSICAL TEST OF AIRCRAFT TIE-DOWN AND LIFTING EYES Final Technical Report, 3–7 Feb. 1969
C. Blair Warren, Mich. Army Tank Automotive Command Feb. 1969 58 p
(Contract DAAE07-68-C-1133)
(AD-687384; TR-10456) Avail: CFSTI CSCL 13/8

The van body tie-down test was performed on a smooth, level, concrete slab containing a fixed group of permanent anchors set in the concrete, each equipped with a heavy attaching ring. The four anchors used in the test agree closely with the spacing of tie-down rings in the C-124 aircraft. For the lifting test, sling cables were attached at each end of a longitudinal spreader bar directly over the lifting eyes. Gradually increasing equal pressure was applied through hydraulic actuators. The van floor was loaded with successively greater weights, to simulate 2.0Gs. Subsequently, the body sides were opened to full expanded position, and then re-closed. These operations proceeded smoothly, with no evidence of binding. Author (TAB)

N69-34315*# Honeywell, Inc., Minneapolis, Minnesota. Aerospace Div.
STERILIZABLE WIDE ANGLE GAS BEARING GYRO FGG3348
J. M. Brenner 23 May 1969 49 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951529)
(NASA-CR-103892; Rept-20584-FRI) Avail: CFSTI CSCL 17G

Test results and recommendations for five gyroscopes previously fabricated are presented. The gyroscopes have single voltage start/run spinmotors and wide angle, pivot, and jewel suspensions. In addition, they meet requirements for heat sterilization and high g capability. Spinmotor reaction torque and gyro interface details were evaluated in acceptance tests. Two of the gyros were subjected to environmental tests. Other results concern vibration and shock, the peizoelectric dither disks, the high-viscosity fill fluid, the compliant thrust jewel mounting, the torque generator, and spinmotor sterilization. K.W.

N69-34324# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NATURAL CORROSION TESTS OF WELDED ALUMINUM-STEEL JOINTS
N. A. Langer et al Mar. 1969 14 p refs Transl. into ENGLISH from Automaticheskaya Svarka (USSR), no. 4, 1968 p 23–28
(AD-687243; FTD-HT-23-1083-68) Avail: CFSTI CSCL 13/8

Joints of AMts and AMg6 aluminum alloys, made by welding to carbon steel or stainless steel with or without additional alloying of the weld metal with 5 percent Si, 7 percent Zn or 1 percent Be, were tested for corrosion in natural sea water and/or in sea atmosphere. Sea water corrosion tests were done with full continuous or periodic submerging; the sea atmosphere tests were done by spraying test specimens with sea water in the air. Corrosion tests were conducted for one year with periodic examinations after 3, 6 and 12 months. The corrosive action of mechanical tests made before and after exposure, and also by visual inspection and measurements of the depth of corrosion damage. Author (TAB)

N69-34333# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ADHESIVES IN MACHINE CONSTRUCTION
M. G. Dranouskii Jan. 1969 10 p Transl. into ENGLISH from Mashinostroitel (Moscow), No. 12, 1967 15 p
(AD-687241; FTD-MT-24-507-68) Avail: CFSTI CSCL 11/1

After listing the advantages and disadvantages of glue-welded joints in machine design and some salient characteristics of various glues, the author reviews the proceedings of the First Moscow Conference on this subject. In all, 42 reports were delivered on the theory of gluing, new synthetic glues for cold and hot hardening, metallic glues, methods for gluing, stability, reliability, and lasting qualities of glued joints, pre-gluing surface preparation, and production and inspection methods for gluing porous surfaces. Author (TAB)

N69-34339# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF PRACTICE FOR COMPOSITE ROLLING OF STRUCTURAL METAL PANELS Final Report, 16 Nov. 1966–30 Nov. 1968

J. R. Van Orsdel, D. N. Williams, and E. S. Bartlett Watertown, Mass. Army Mater. and Mech. Res. Center 20 May 1969 126 p refs
(Contract DA-19-66-AMC-308(X))
(AD-687331; AMMRC-CR-66-02(F); G-7515) Avail: CFSTI CSCL 13/8

A program was conducted to adapt the roll-diffusion bonding process to the fabrication of a number of special structural alloys. The alloys studied in this program were: (1) Ti-4Al-0.2 O2 alpha titanium alloy; (2) Ti-8Mo-8V-2Fe-3Al beta titanium alloy; (3) PH 14-8Mo precipitation-hardening steel; (4) 18Ni-250 maraging steel; (5) Rene 41 nickel-base superalloy; (6) Alloy 718 nickel-base superalloy. Studies on each alloy were conducted in progressive steps from initial or simplified laboratory investigations through various scale-up stages. At the conclusion of the program, a number of flat square panels and right circular cylinders were prepared from the roll-bonded material for mechanical evaluation. Author (TAB)

N69-34414# Army Foreign Science and Technology Center Washington, D.C.
STEPPED GEAR SYNCHRONIZERS
V. I. Krasnenkov et al May 1969 237 p refs Transl. into ENGLISH of Mashinostr. (Kiev), 1967 p 1–198
(AD-688523; FSTC-HT-23-430-68) Avail: CFSTI CSCL 13/6

The book concerns Soviet and foreign experience in the design and use of synchronizers in the step gear boxes of transport vehicles. Side by side with description of the basic steps in the development of the gear engagement mechanisms and of the design used in synchronizers of domestic and foreign manufacture, in this work much attention is devoted to the theory of gear engagement in gear boxes equipped with synchronizers, and to figuring out the basic parameters of synchronizers in the light of the intended purpose of the vehicle and the conditions under which it will be used as well as of the peculiarities of the transmission layout and the drive operation. Author (TAB)

N69-34437# Sandia Corp., Albuquerque, N.Mex.
TOOLING DEVELOPMENT FOR MACHINING UNFIRED ALUMINUM OXIDE
J. P. Myers comp. Jan. 1969 11 p refs
(SC-DR-68-879) Avail: CFSTI

An investigation of the best methods and tools for machining unfired aluminum oxide was made. A grinding wheel is preferred for milling large areas; diamond-tip tools are preferred for all lathe operations; and for drilling, counter-boring, and form machining, extremely sharp fired Al_2O_2 tooling is best. Author (NSA)

N69-34448# Mechanical Technology, Inc., Latham, N.Y.
EXPERIMENTAL INVESTIGATION OF A STEAM LUBRICATED ROTOR-BEARING SYSTEM: STEADY-STATE LOAD AND STEAM HAMMER INSTABILITY TESTS
S. B. Malanoski and F. K. Orcutt Jan. 1969 52 p refs
(Contract AT(30-1)-3839)
(NYO-3839-5; MTI-68-TR-82) Avail: CFSTI

Steady-state load performance and steam hammer instability characteristics of the rotor-bearing system with a single-acting thrust bearing (unidirectional thrust load support capability) was obtained. Measurements of the steady-state load capacity and stiffness of the journal bearings and single-acting thrust bearing using both nitrogen and steam as lubricants were made. Conditions are described for onset and suppression of steam hammer instability of the journal and single-acting thrust bearings operating under realistic environmental conditions. Author (NSA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-33299*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF LASER-DOPPLER GAS VELOCITY INSTRUMENTATION
Robert M. Huffaker *In its* Res. Achievements Rev., Vol. 3 1968 p 91–98 refs (See N69-33289 19-31)
Avail: CFSTI CSCL 20E

The development of laser-Doppler instrumentation for use in both the wind tunnel and atmospheric applications is reviewed, including a heterodyne technique for measuring both the local mean and the fluctuating gas velocity with high spatial and temporal resolution. In optical heterodyning, two coherent, monochromatic light beams with different frequencies are directed simultaneously onto the photosensitive surface of a photodetector. The intrinsic square-law response of the photodetector leads to an electrical output signal with a frequency equal to the frequency difference between the two incident light beams. Optical heterodyning thus allows a direct measurement of the frequency difference between two coherent, monochromatic light beams from a few Hertz to giga-Hertz corresponding to almost zero velocity to very high Mach numbers. The measurement of this beat signal frequency, together with the geometry of the optical system, determines the flow velocity of the gas. The laser-Doppler instrumentation was also needed for the measurement of atmospheric wind velocity and turbulence that create the Saturn V ground wind problems. Author

N69-33303*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LASER TRACKING AND COMMUNICATION WITH SATELLITES
H. H. Plotkin Oct. 1968 30 p refs
(NASA-TM-X-63614; X-524-69-193) Avail: CFSTI CSCL 20E

Four U.S. satellites equipped with special passive retroreflectors are now being tracked, by ruby lasers, to a precision of about 1 meter. They are being used for evaluation of other tracking systems, improvement of satellite orbits, and consequently improvement of knowledge of station locations and the earth's gravity field. Further expected advance in precision, to study lunar motion, continental drift, earth wobble, etc., requires better lasers, detection systems, and telescopes. Satellite experiments with continuous lasers such as argon and carbon dioxide are also leading to new optical tracking and satellite navigation techniques. Areas requiring immediate attention include study of atmospheric effects on the communication channel; improvement in the efficiency, stability, power, lifetime, and tunability of candidate lasers; development of wide-band radiation-cooled mixers at 10 microns; and development of techniques for acquiring and tracking satellite communication terminals, both from satellites and on the ground. Author

N69-33309*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LASER DOPPLER SYSTEM FOR MEASURING THREE-DIMENSIONAL VECTOR VELOCITY
Robert M. Huffaker, inventor (to NASA), Kenneth F. Kinnard, inventor (to NASA) (Raytheon Co.) and Edward Rolfe, inventor (to NASA) (Raytheon Co.) Filed 22 Apr. 1969 10 p
(NASA-Case-MFS-20386; US-Patent-Appl-SN-818349) Avail: CFSTI CSCL 20E

A laser Doppler velocimeter has been developed for measuring the mean velocity and turbulence of a fluid flow. Optical homodyning

of a portion of a laser beam scattered from moving particles embedded in a flowing fluid with a portion of the laser beam is made from three different viewing angles to produce beat signals at the frequency of the Doppler shift due to the motion of the fluid. The Doppler shift signal containing the mean velocity and turbulence information is frequency demodulated to produce a fluctuating dc output. The dc output corresponds to a carrier frequency or mean velocity of the fluid and a time-dependent random signal corresponding to the turbulent fluctuations in the fluid flow. NASA

N69-33312*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ACQUISITION AND TRACKING FOR OPTICAL RADAR

Charles L. Wyman, inventor (to NASA), John M. Gould, inventor (to NASA), Robert E. Johnson, inventor (to NASA) (Sylvania), and Paul E. Weiss, inventor (to NASA) (Sylvania) Filed 4 Jun. 1969 16 p

(Contract NAS8-11918)

(NASA-Case-MFS-20125; US-Patent-Appl-SN-830366 Avail: CFSTI CSCL 20E

A laser based tracking system is described which has capability of automatically performing an acquisition search to locate a target. In the acquisition mode, a laser beam and the instantaneous field of view of an image dissector photomultiplier are electronically and co-axially scanned over the same acquisition field. Upon acquisition of the target, the image dissector's instantaneous field of view is scanned across the target in a cross scan pattern to generate a differential error signal indicative of the offset of the target from the center of the cross scan pattern. The error signal is fed back to center the laser beam and the cross scan pattern on the target. If acquisition of the target is lost for a predetermined time the system returns to the acquisition mode to scan both the laser beam and instantaneous field of view of the image dissector over the acquisition field of view. The system was developed to provide precise launch phase tracking from liftoff to a slant range of 10 km of a corner cube reflector placed on the instrument unit of the Saturn 5. NASA

N69-33388# Library of Congress, Washington, D.C. Aerospace Technology Div.

FOREIGN SCIENCE BULLETIN, VOLUME 5, NUMBER 6 Monthly Review of Selected Foreign Scientific and Technical Literature

Jun. 1969 98 p refs

Avail: CFSTI

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N69-33389# Library of Congress, Washington, D.C. Aerospace Technology Div.

SOVIET LIQUID LASERS

Yuri Ksander *In its* Foreign Sci. Bull., vol. 5, no. 6 Jun. 1969 p 1–17 refs (See N69-33388 19-16)

Avail: CFSTI

Three classes of liquid lasers are currently under development: chelates, organic dyes, and inorganic compounds. According to Soviet claims, recent successes with phosphorus–oxychloride liquids surpass the best American results with similar selenium–oxychloride lasers. Author

N69-33391# Library of Congress, Washington, D.C. Aerospace Technology Div.

RARE-EARTH ELEMENT CHELATES AS ACTIVE MATERIALS OF LIQUID LASERS

John Kourilo *In its* Foreign Sci. Bull., vol. 5, no. 6 Jun. 1969 p 56–66 refs (See N69-33388 19-16)

Avail: CFSTI

Trends and achievements in Soviet laser related research on rare-earth chelates are briefly examined on the basis of available literature published from July 1967 through March 1969. New trends are seen in studies of photochemical stability of rare-earth β-diketonates, solvent effects, chelate isomerization, and the effect of a second rare-earth ion admixture. Discovery of a new mechanism of inter-intramolecular energy transfer via an intermediate organic molecule in solution signifies an increase in efficiency in nonradiative energy transfer from the sensitizer molecule to the chelate molecule. The search for ligands with wider and less intensive absorption spectra than those of benzoylacetonate is indicated as a possible way to overcome the inherent shortcomings of the rare-earth chelates presently used in laser experiments. Author

N69-33708# California Univ., Berkeley

TELECOMMUNICATIONS BY LASER USING ANOTHER LASER AS A THERMAL WAVEGUIDE.

B. Joly Paris ESRO Jul. 1967 31 p refs

(ESRO-SN-72) Avail: CFSTI

In order to solve the various problems still occurring in telecommunications by laser (perturbations due to diffraction, scintillation noise, absorption and air turbulence), the author suggests the use of a thermal waveguide, consisting in a second beam of coherent light, preferably in the infrared, coaxial to the first beam and protecting it from outside perturbations. The effect of this waveguide on scintillation noise and propagation is computed by applying a correlation technique to the statistical fluctuations of the refractive index. Calculation shows that such a waveguide would lower scintillation noise and suppress the diffraction effect due to local microturbulences. As regards propagation, the presence of the thermal waveguide would result in self-focusing of the beam. In the last section, the author discusses the phenomena recently described by Whitten and asks whether these could not have been due to atmospheric turbulence. He suggests that non-linear effects might produce self-focusing at a power level much lower than that necessary for the occurrence of self-trapping. Author (ESRO)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-33213# Martin Co., Denver, Colo. Center for High Energy Forming.
CENTER FOR HIGH ENERGY FORMING Quarterly Technical Progress Report
Jimmy D. Mote 1 Apr. 1969 21 p
(Contract DA-19-066-AMC-266(X); ARPA Order 720)
(AD-687329; AMRA-CR-66-05-18; QTPR-15) Avail: CFSTI CSCL 13/8

Preliminary results of the computer program for calculating the dynamic plastic response of circular blanks subjected to underwater explosions are described. Experimental measurements of dynamic strain and pressure are compared with the theoretical predictions. Analytical and experimental work on the energy transfer during explosive welding is reported. The preliminary results on the effect of explosive forming on fracture toughness, microstructure, fatigue, and stress-corrosion cracking of metals is described. The formation of brittle intermetallic phases during explosive welding is discussed. The results of experiments to determine the strain rate effects on D6AC and 4130 steel are reported. Results on energy transfer and high velocity metal deformation as it relates to explosive expansion of rings, shock wave attenuation through bubble curtains, flange buckling of explosively formed domes, and prediction of edge pull-in in explosively formed domes is discussed. Recent results on explosive punching of dual hardness armor and electromagnetic forming are reported. Author (TAB)

N69-33249# Naval Research Lab., Washington, D.C. Metallurgy Div.
FRACTURE TOUGHNESS CHARACTERIZATION PROCEDURES AND INTERPRETATIONS TO FRACTURE-SAFE DESIGN FOR STRUCTURAL ALUMINUM ALLOYS Interim Report
R. W. Judy, Jr., R. J. Goode, and C. N. Freed 31 Mar. 1969 29 p refs
(AD-687396; NRL-6871) Avail: CFSTI CSCL 11/6

Interpretations of fracture toughness characteristics as measured by various test procedures are presented for structural aluminum alloys. Quantitative definitions of the significance of engineering fracture toughness tests are provided by extension of analytical procedures evolved from fracture mechanics theory. The procedural simplicity of the engineering tests coupled with the analytical capabilities of fracture mechanics theory provides for a significant advancement in fracture-safe design procedures for aluminum alloys covering the full range of yield strength. Author (TAB)

N69-33250# Naval Research Lab., Washington, D.C. Chemistry Div.
THE CORROSION PRODUCTS OF IRON AND THEIR RELATION TO CORROSION IN STEAM-GENERATING EQUIPMENT Interim Report
M. C. Bloom and Somers H. Smith, Jr. 1 Apr. 1969 16 p refs
(AD-686851; NRL-6874) Avail: CFSTI CSCL 11/6

The possibility of avoiding serious pitting in the generating tubes of naval boilers depends on the genesis and preservation of proper corrosion product films. The spinel films (Fe_3O_4) normally produced as a result of exposure to slightly alkaline sodium hydroxide solutions are protective but porous to the solution. Reaction at the metal surface beneath these films may give rise to drastic concentration effects under some operating conditions. When films formed become too thick as a result of such concentration effects, they may fracture, allowing free access of the solution to the metallic surface at a local spot beneath the fractured film with resultant danger of deep pitting. There is evidence that the use of lithium hydroxide instead of sodium hydroxide avoids this concentration effect. Author (TAB)

N69-33255# Naval Research Lab., Washington, D.C. Metallurgy Div.
STRESS CORROSION CRACKING CHARACTERIZATION PROCEDURES AND INTERPRETATIONS TO FAILURE-SAFE USE OF TITANIUM ALLOYS Final Report
R. W. Judy, Jr. and R. J. Goode 8 Apr. 1969 14 p refs
(AD-687397; NRL-6879) Avail: CFSTI CSCL 11/6

Ratio Analysis Diagram (RAD) interpretive procedures have been evolved recently to provide generalized engineering solutions for fracture toughness assessments of structural titanium alloys. Failure-safe design also requires consideration of possible subcritical crack propagation (slow fracture) due to stress-corrosion cracking (SCC). Procedures for the incorporation of SCC characterizations into the RAD system have now been developed. These procedures serve the dual purpose of providing simplified interpretations of critical flaw size-stress instability conditions by the consideration of the resistance of the material to both fast fracture and SCC. Author (TAB)

N69-33269*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENGINEERING MECHANICS DIVISION
In its Supporting Res. and Advanced Develop. 30 Apr. 1969 p 149-170 (See N69-33263 19-31)
Copyright: Avail: CFSTI CSCL 11F

Aluminum silicon wires were stress tested until failure in order to determine their strengths in packaged integrated circuit devices; tensile failures closely resembled those of single crystal fracture indices. Coupled flow field programs were acquired for computing planetary entry phenomena and unfurlable spacecraft antenna designs. Natural coordinate systems were used to develop mesh configurations that can be generated in a few seconds of computer time. Embedment pressure effects on electronic packaging and cabling were evaluated in a test program after thermal sterilization results showed that the embedment pressure increased after sterilization. G.G.

N69-33307*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXIDATION AND THERMAL FATIGUE CRACKING OF NICKEL- AND COBALT-BASE ALLOYS IN A HIGH VELOCITY GAS STREAM
James R. Johnston and Richard L. Ashbrook Washington Aug. 1969 50 p refs
(NASA-TN-D-5378) Avail: CFSTI CSCL 11F

The superalloys IN-100, B-1900, Mar M-200, TAZ8A, Hastelloy X, TD-NiCr, L-605, X-40, Mar M-509A, and WI-52 were cyclically tested for resistance to oxidation in high velocity gas streams for 100 cycles between room temperature and temperatures up to 2000°F. Conventionally cast nickel base alloys were more resistant to weight loss than cast cobalt base alloys, but cast cobalt base alloys were more resistant to thermal fatigue cracking. However, Hastelloy X and directionally solidified and single grain Mar M-200 did not crack even after 100 cycles to 2000°F. Simulated steady state conditions reduced weight loss and incidence of cracking of the six alloys so tested. Author

N69-33351# Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.
DETERMINING THE WEIGHT OF STEEL IN THE ELECTRIC FURNACE BY RADIOACTIVE ISOTOPES [DETERMINAZIONE DEL PESO DELL'ACCIAIO NEI FORNI ELETTRICI MEDIANTE ISOTOPI RADIOACTTIVI]
P. G. Caldera, F. Pavesio, and S. Piccinini (Fiat S.p.A.) 1968 19 p refs In ITALIAN Presented at 13th AIM Natl. Congr., Milan, 16-19 Jun. 1969
(SORIN-147; M/335) Avail: CFSTI

A method for determining the weight of liquid steel in an electric furnace before casting, by radioactive isotopes, is described. This is essentially a dilution method. A quantity of radioactive gold is introduced into the liquid bath of steel and, when this is uniformly distributed, the determination is made by measuring the activity of a sample; from this, the quantity of steel present is calculated. Experimentation with electric furnaces has permitted the optimization of practical applications of the method, and the determination of better than 1% precision. This method is being experimentally utilized in the Martin furnace. Transl. by F.O.S.

N69-33381# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
FAST NEUTRON DAMAGE IN ZIRCONIUM-BASED STRUCTURAL ALLOYS [ENDOMMAGEMENT DU AUX NEUTRONS RAPIDES DANS LES ALLIAGES STRUCTURELS A BASE DE ZIRCONIUM]
C. D. Williams and R. W. Gilbert Jun. 1969 17 p refs Presented at the IAEA Symp. on Radiation Damage in Solids and Reactor Mater., Vienna, 2-6 Jun. 1969
(AECL-3308; SM-120/C-3) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

Damage accumulation in Zircaloy-2 irradiated to fluences up to 10^{22} n.cm $^{-2}$ at ~300°C is described with an account of the defect behaviour during post-irradiation annealing. Transmission microscopy of Zircaloy-2 pressure tube and fuel sheath material irradiated at 260°–320°C shows that: (1) the total visible density of the clusters and loops increases initially with fluence; (2) this density does not increase significantly with longer irradiation at these temperatures; (3) no evidence is found of the growth of dislocation loops to diameters greater than 200 or of the formation of complex tangles. No evidence is found for the formation of three dimensional voids of the type reported in steels subjected to high fluences at 350–560°C, either in Zircaloy-2 irradiated to > 10^{21} n.cm $^{-2}$ ~300°C or in similar material irradiated. Loop expansion and interaction results in an increase in line dislocation density. Defect recovery is found to be strongly dependent upon annealing temperature but is not markedly dependent on fluence accumulated before annealing. Author

N69-33607# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.
THE URANIUM AGE [DAS URANZEITALTER]
M. J. Higatsberger 1969 15 p In GERMAN
(SGAE-G-12/1969) Avail: CFSTI

Reviewed are discovery, history, and properties of radioactive uranium isotopes with emphasis on the many possibilities of nuclear power applications. The overall importance of the uranium discovery is projected by naming the latest development period in man's history the "uranium age" in contrast to the earlier stone-, bronze-, and iron ages. Transl. by G.G.

N69-33624# Naval Research Lab., Washington, D.C.
CORROSION OF METALS IN TROPICAL ENVIRONMENTS. PART 9: STRUCTURAL FERROUS METALS: SIXTEEN YEARS' EXPOSURE TO SEA AND FRESH WATER Interim Report
C. R. Southwell and A. L. Alexander Apr. 1969 32 p refs
(AD-687705; NRL-6862-Pt-9) Avail: CFSTI CSCL 11/6

Effects of corrosion on 20 structural ferrous metals immersed in seawater and fresh water and exposed at mean-tide elevation have been measured at various intervals during 16 years. Corrosion rates and time-corrosion curves derived from both weight loss and pitting have been established. The final constant rates provide significant data for comparing the corrosion resistance of the different metals in the various environments and for estimating service life over more extended periods. Author (TAB)

N69-33731# Royal Aircraft Establishment, Farnborough (England).
THE FATIGUE STRENGTH OF COMMERCIAL TITANIUM ALLOYS [DAUERSCHWINGFESTIGKEIT DER TECHNISCHEN TITANLEGIERUNGEN]
M. Hempel and E. Hillnhagen Mar. 1969 31 p refs Transl. into ENGLISH from Arch. Eisenhuettenw. (Germany), v. 37, no. 3, 1966 p 263–274
(RAE-LIB-Trans-1353) Avail: CFSTI

Fatigue tests have been carried out on two commercial titanium alloys. Flat specimens of forged and rolled sheets were subjected to plane bending and round specimens of forged bars were subjected to direct stressing, rotating bending and torsional loading. The TiA15Sn2.5 was tested in the annealed condition and TiAl6V4 in the annealed and solution treated and aged conditions. The effects on the fatigue strength, of specimen shape, finish, heat treatment and type of stress are reported. Notch effect factors were also determined. Metallographic investigations of the reasons for the large scatter in the experimental results and a study of the propagation and extent of fatigue cracking were carried out. The results are compared with published literature. Author

N69-33742# California Univ., Berkeley. Lawrence Radiation Lab.
STRUCTURE AND MECHANICAL PROPERTIES OF Fe-Ni-Co-C STEELS
Santosh Kumar Das (M.S. Thesis) Dec. 1968 84 p refs
(Contract W-7405-eng-48)
(PB-182928; UCRL-18652) Avail: CFSTI CSCL 11F

The structure and mechanical properties of tempered martensite and bainite were investigated in a series of steels with varying C, Ni and Ca contents. At similar Ms temperatures, the martensite in the 0.24% carbon steels exhibited very small amounts of twinning compared to the 0.4% carbon steels. At equivalent yield and ultimate tensile strength levels the mainly untwinned martensite showed considerably higher toughness than the heavily twinned ones. The structure of lower bainite showed laths or plates of ferrite with internal carbides but no internal twins. The strength and toughness of isothermally transformed lower bainite was found to decrease with increasing transformation temperature. This was associated with increased coarsening and grain boundary precipitation of the carbides at higher transformation temperatures. At similar strength levels the toughness of lower bainite was found to be superior to the heavily twinned martensite, but inferior to that of the mainly untwinned martensite. Thus, the role of microtwins in lowering the toughness has been demonstrated in two ways. Firstly by comparison between the heavily twinned and mainly untwinned martensite and secondly by comparing the martensite with bainite. Author (USGRDR)

N69-33758# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
PROSPECTS FOR ZIRCONIUM STRUCTURAL ALLOYS AT HIGH TEMPERATURES
W. R. Thomas May 1969 15 p refs Presented at the 1969 Can. Nucl. Assoc. Ann. Conf., Montreal, 8–12 Jun. 1969 Its Paper 69-CNA-539
(AECL-3362) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

Improved station efficiencies and lower capital costs provide incentives for the development of zirconium alloys for pressure tubes which can operate at tempratures above 450°C. The experience of the Ti industry indicates that a complex alloy containing solution hardeners of Sn or Al and precipitation hardeners of Mo and Nb and perhaps Si will be required. The thermal neutron cross-section of the alloy will be about 10% higher than Zircaloy-2 and because of its poor corrosion resistance will require cladding with a corrosion resistant alloy such as Zr-Cr. Results to date indicate that such a pressure tube is feasible. Author

N69-33760# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

MICROSTRUCTURAL AND DIMENSIONAL CHANGES IN STRIPS OF MAGNOX Zr 55 EXPOSED TO CARBON DIOXIDE AT ELEVATED TEMPERATURES AND PRESSURES

J. C. Wood Jan. 1969 14 p refs

(RD/B/N1286) Avail: CFSTI

Strips of the alloy Mg, 0.55% Zr have been exposed to nuclear grade CO_2 at temperatures in excess of 500°C at pressures ≈ 20 atmospheres. The strip extensions in width and length, have been measured and the strain rate is found to be increased by an order of magnitude when hydrocarbon vapors are present in the gas. Metallographic examination of the specimens has revealed a duplex substructure in the metal, core, and outer zones being separated by a narrow band of zirconium rich precipitate. At grain boundaries in the external zone, networks of bands, denuded of precipitate, have been observed. They are preferentially aligned perpendicular to the strip surface and account for the measured macroscopic strain. The duplex nature of subsurface structure is observed only beneath surface areas covered by black/grey deposits. Author

N69-33769# Boeing Co., Renton, Wash. Commercial Airplane Div.

THE EFFECT OF SILICON ON THE STRESS CORROSION RESISTANCE OF LOW-ALLOY, HIGH-STRENGTH STEELS

C. S. Carter Mar. 1969 16 p refs

(Contract N00014-66-C-0365; ARPA Order 878)

(AD-687726; D6-23872) Avail: CFSTI CSCL 11/6

The effect of five levels of silicon, within the range 0.09 to 2.15 wt %, on the stress corrosion resistance of 4340 steel was established in 3.5% sodium chloride solution for two tensile strength ranges (280 to 300 ksi and 230 to 240 ksi). At the higher strength range, the threshold stress intensity was independent of silicon content, but the stress corrosion crack velocity was significantly retarded when the silicon content exceeded 1.5 wt %. At the 230- to 240-ksi strength range, steels containing less than 1.5 wt % silicon exhibited a higher K sub Iscc threshold than steels of higher silicon content. Strength level had a significant effect on crack velocity characteristics. Author (TAB)

N69-33770# Boeing Co., Renton, Wash. Commercial Airplane Div.

STRESS CORROSION CRACK BRANCHING IN HIGH-STRENGTH STEELS

C. S. Carter Mar. 1969 13 p refs

(Contract N00014-66-C-0365; ARPA Order 878)

(AD-687725; D6-23871) Avail: CFSTI CSCL 11/6

The criteria for stress corrosion crack branching in high-strength steels are shown to be (1) a constant crack velocity and (2) attainment of a critical stress intensity K sub Ib. For the steels investigated, values of K sub Ib/K sub Iscc range from 2 to 4. This indicates that when K sub Iscc/K sub Ic exceeds 0.5, rapid brittle fracture will occur before K sub Ib can be reached. Author (TAB)

N69-33771# Boeing Co., Renton, Wash. Commercial Airplane Div.

THE USE OF DEFORMATION VOIDS TO REFINE THE AUSTENITE GRAIN SIZE AND IMPROVE THE MECHANICAL PROPERTIES OF AFC 77

Donald Webster Feb. 1969 13 p refs

(Contract N00014-66-C-0365; ARPA Order 878)

(AD-687724; D6-23870) Avail: CFSTI CSCL 11/6

A process was developed for refining the austenite grain size of martensitic steels. The process uses deformation in the tempered martensitic condition to produce deformation voids around hard carbide particles which then pin austenite grain boundaries during subsequent austenitizing treatments. Mechanical properties were determined on a martensitic stainless steel, AFC 77, whose austenite grain size had been refined from 60 to 2.3 microns by this process. Increases of 20 to 60 ksi in yield strength were obtained with little change in toughness. Stress corrosion resistance was increased and the fatigue crack growth rate decreased for most tempering temperatures. Author (TAB)

N69-33795# California Univ., Livermore. Lawrence Radiation Lab.

REFRACTORY ALLOY DEVELOPMENT FOR THE ADVANCED SPACE POWER REACTOR PROGRAM

L. W. Roberts, Jr. and G. S. Root 17 Mar. 1969 16 p refs

(UCRL-50603) Avail: CFSTI

The deformation of W, Re, and W–Re alloys at high temperatures was characterized and a basis was found for developing stronger alloys. A chemical vapor-deposition process was invented for making W–Re tubing with good mechanical properties. Surface contamination of tungsten particles was found to be the obstacle to the incorporation of submicron and second-phase particles in a tungsten matrix. State-of-the-art tungsten-alloy technology was found wanting but amenable to improvement. Welding or bonding T-111 alloy to W–Re–Mo was unsuccessful. Techniques were created to study corrosion of tungsten alloys by lithium. A seven-unit facility for tensile creep testing at 10^{-10} torr at elevated temperatures was established. Author (NSA)

N69-33805# Illinois Univ., Urbana. Dept. of Mining, Metallurgy and Petroluem Engineering.

X-RAY MASS ABSORPTION COEFFICIENTS AND QUANTITATIVE MICROANALYSIS OF METALLURGICAL SYSTEMS, INCLUDING REFRACTORY METAL-INTERSTITIAL COMPOUNDS

Lawrence John Gray (Ph.D. Thesis) Feb. 1969 231 p refs

(Contract AT(11-1)-1198)

(COO-1198-621) Avail: CFSTI

A method, based on consideration of atomic potentials, for the estimation of mass absorption coefficients is described. Mass absorption coefficients for wavelengths up to 80 Å can be estimated. Numerical values are given for several elements, including the refractory metals, for the characteristic emission lines of carbon, nitrogen, and oxygen. The method of calculation permits the estimation, to better than 5% in most cases, of mass absorption coefficients. A correction procedure for the conversion of microprobe x-ray intensity data to composition is presented. The method, implemented by a described computer program, was tested in the analysis of eight metallurgical systems containing elements from carbon to gold in various combinations. The data reduction computation has been shown to be generally applicable to this variety of elements. The greatest difficulties were encountered in the analysis of carbon containing samples. Author (NSA)

N69-33850# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Lab.
THE STRESS-RUPTURE PROPERTIES OF HEAT-TREATED ZIRCONIUM-2.5 PERCENT NIOBIUM ALLOY
E. F. Ibrahim May 1969 15 p refs
(AECL)-3361) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

Stress-rupture tests at 300 to 450° C on specimens from pressure tubes of heat-treated Zr-2.5% Nb are reported. The calculated rupture stress for 30 years at 300°C is 49.2 kpsi (34.6 kgf/nm^2). This is greater than cold-worked Zircaloy-2 but less than cold-worked Zr-2.5% Nb alloy. The effect of temperature and time to rupture on rupture ductility is analyzed using a Larsen – Miller parameter for heat-treated Zr-2.5% and compared with results on cold-worked Zircaloy-2 and cold-worked Zr-2.5% Nb. Author

N69-33851# Electricity Council Research Center, Capenhurst (England).
INDUCTION REHEATING OF LARGE METALLIC MASSES: A REVIEW
C. J. Edgerley, A. M. Guthrie, and R. D. Langman Dec. 1968 46 p refs
(ECRC/M137) Avail: CFSTI

The possibility of using induction reheating techniques in the metallurgical industry with particular reference to steel works producing strip is discussed. The technology is by no means novel but certain deficiencies in practice are considered which present problems soluble only by laboratory and pilot plant examination. Author

N69-33867# Bristol Aerojet, Ltd., Banwell (England).
FORMING OF HIGH STRENGTH METALS
D. J. Campion [1969] 41 p refs Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 9–11 Apr. 1969
Avail: CFSTI

It is shown that maraging steel, taken as representative of high strength steel, may be pressed and deep drawn. When the component is pressed rather than deep drawn, i.e. where stretch forming mechanisms are at work, it is shown that maraging steel exhibits a pronounced tendency to thin. It is concluded that by heating the sheet and the tools, maraging steel may be deformed to the same extent as a deep drawing quality stainless steel. Author (ESRO)

N69-33898# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
TENSILE AND STRESS-RUPTURE PROPERTIES OF ROLLED Pb-Cd-Sb ALLOYS
Milton M. Tilman Aug. 1969 14 p refs
(BM-RI-7285) Avail. Issuing Activity

In an investigation to develop lead alloys with improved tensile strength and creep resistance, lead-base alloys containing cadmium and antimony in nominal 1-to-1 atomic ratios were melted in air, cast, and rolled into sheet to 90 percent reduction at temperatures varying from room temperature to 175°C. Tensile testing at room temperature and stress-rupture testing at 90° ± 3°F were conducted on the as-rolled alloys. The best tensile properties were observed in an alloy of Pb-4.2 wt pct Cd-4.5 wt pct Sb which exhibited an average tensile strength of 7,270 psi with 38 percent elongation in 2 inches. An alloy of Pb-5.6 wt pct Cd-6.0 wt pct Sb had 100-hour stress-rupture values of approximately 2,100 psi and 1,000-hour values of approximately 1,700 psi. Author

N69-33830# Junta de Energia Nuclear, Madrid (Spain). Division de Metalurgia.
CONTRIBUTION TO THE METALLOGRAPHIC STUDY OF ZIRCONIUM HYDRIDES IN ZIRCALOY-2 [CONTRIBUCION AL ESTUDIO POR METALOGRAFIA DE LOS HIDRUROS DE CIRCONIO EN ZIRCALOY-2]
F. Garcia Gonzalez 1968 19 p refs In SPANISH; ENGLISH summary
(JEN-199-DMe/I-19) Avail: CFSTI

Techniques for the identification of the zirconium hydrides in metallographic specimens have been developed. Microhardness, quantitative estimation and relative orientation of the present hydrides have been determined. Grain size determination of the different zircaloy-2 tube specimens has also been made. The specimens used were corrosion-tested in water during various periods of time at 300°C, prior to the metallographic examination. Reference specimens, as received, and heavily hydrided specimens in a hydrogen atmosphere at 800°C, have been used in the previous stages of the work. No difficulties have been met in this stage. Author (ESRO)

N69-33884# Royal Aircraft Establishment, Farnborough (England).
YIELD IN DISPERSION HARDENED COPPER ALLOYS
G. Dorey Sep. 1968 30 p refs
(RAE-TR-68230) Copyright. Avail: CFSTI

Single crystals of copper containing dispersed particles of alumina and silica have been tested in tension, to determine how dislocations pass oxide particles intersecting their slip planes. Tensile tests were conducted on five Cu-Al_2O_3 alloys at various temperatures from 78°K to 1170°K. The strain rate sensitivity and the effect on flow stress of diffusing 10 wt % Zn into the Cu matrix were measured for Cu-2.6 vol % Al_2O_3 over the same temperature range. Thin foils for transmission electron microscopy were prepared from the gauge lengths of the strained crystals to examine dislocation structures and the size and spacing of oxide particles. It is concluded that the critical shear stress is the shear stress needed to force dislocations between particles larger than a critical size: particles smaller than the critical size are passed by a cross-slip mechanism. Author (ESRO)

N69-34077# Kerforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
THE FORMATION OF VOIDS IN METALS BY NEUTRON IRRADIATION [DIE PORENBILDUNG IN METALLISCHEN WERKSTOFFEN DURCH NEUTRONENBESTRAHLUNG]
H. Boehm Sep. 1968 52 p refs In GERMAN
(KFK-383) Avail: AEC Depository Libraries

The previously known data on the formation of voids in metals as a result of radiation were summarized, and a review was given of the models for the origin of void formation in order to give the effect of various parameters on the formation of voids and the property modifications caused by the voids. The compilation of theory and previous experimental study was intended as a guide to further experimental and theoretical treatment of the formation of voids. Author (NSA)

N69-34158# Atomic Weapons Research Establishment, Aldermaston (England).
BERYLLIUM TECHNOLOGY
J. N. Lowe 1969 14 p refs Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 9–11 Apr. 1969
Avail: CFSTI

The technological status of beryllium fabrication is established and it is shown that it is useful for a variety of applications in advanced engineering projects. However, little success has been achieved in alleviating the brittleness characteristic of the metal. ESRO

N69-34163# Rocket Propulsion Establishment, Westcott (England).
APPLICATIONS OF SOME REFRACTORY METALS IN SPACE TECHNOLOGY
P. J. Sherwood 1969 9 p refs Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 9–11 Apr. 1969
Avail: CFSTI

The use of tungsten in uncooled rocket nozzles and of tungsten and rhenium in electrothermal propulsion devices is described, and the properties required for successful operation are discussed. ESRO

N69-34187# Army Foreign Science and Technology Center, Washington, D.C.
ANTICORROSIVE SERVICE
L. Kamionskii May 1969 12 p Transl. into ENGLISH from Nauchn.-Tekhn. Obshchestva SSSR (Moscow), v. 10, no. 6, 1968 p 11–13
(AD-688526; FSTC-HT-23-786-68) Avail: CFSTI CSCL 11/6

A review of new developments in corrosion protection of ferrous metals including improved lubricants, silicate enameling and volatile inhibitors, etc. Author (TAB)

N69-34193# Drexel Inst. of Tech., Philadelphia, Pa. Dept. of Metallurgical Engineering.
SPHEROIDIZATION OF BINARY IRON-CARBON ALLOYS OVER A RANGE OF TEMPERATURES
Richard W. Heckel and Krishna M. Vedula Apr. 1969 38 p refs
(Contract N00014-67-A-0406-0002)
(AD-687738; TR-1) CSCL 11/6

The spheroidization of cementite in binary iron-carbon alloys was investigated over a range of temperatures (594, 649, and 704C) for times up to about a million seconds. Quantitative metallography techniques were used to obtain the following microstructural data on the cementite particles: shape, size distribution, mean size, number of particles per unit volumes, and growth (and shrinkage) rates of various sizes in the size distribution. The variations of these microstructural parameters were analyzed in terms of existing models for the spheroidization process. Author (TAB)

N69-34231# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FACTORS AFFECTING THE MECHANICAL PROPERTIES OF STAINLESS STEELS AT MPRE OPERATING TEMPERATURES
W. R. Martin Feb. 1966 22 p refs
(Contract W-7405-eng-26)
(ORNL-TM-1382) Avail: CFSTI

The mechanical properties pertinent to use in the MPRE for types 304 and 316 stainless steel were reviewed. The strength of the unirradiated wrought materials is adequate, but the lower strength of weld metal will have to be considered in design. Irradiation has a greater effect on ductility than does temperature; quantitative information on radiation embrittlement in creep is inadequate. Author (NSA)

N69-34241# Atomics International, Canoga Park, Calif.
MECHANICAL BEHAVIOR OF TYPE 304 STAINLESS STEEL IN COPPER-CONTAMINATED SODIUM IN THE RANGE 950 TO 1300°F
D. F. Atkins 1 Apr. 1969 30 p refs
(Contract AT(04-3)-701)
(AI-AEC-12788) Avail: CFSTI

Biaxial stress-rupture tests on Type 304 stainless steel tubing were performed in static Na retorts at 950, 1100, 1300°F. Pure Cu tabs were immersed in the Na to provide a Cu-saturated condition throughout the test duration. Results were compared with identical tests in Cu-free Na. Charpy impact specimens, exposed to the Na–Cu environment during the stress rupture tests, were subsequently tested at −75°C. It was found that the presence of Cu in sodium did not influence the stress rupture behavior and impact strength of 304 stainless steel at temperatures up to 1300°F. Although testing at 1300°F did not exceed 1200 hours, microstructural examinations indicated that much longer exposures could be tolerated. No serious penetration of Cu into the stainless steel was observed. Cu dissolved in Na was found to deposit on the stainless steel in the isothermal region of the 950°F static Na test, but at 1100 and 1300°F, Cu deposits occurred only in regions where the Na bath was slightly cooler. No Cu was found in the Na vapor regions of the retorts. Author (NSA)

N69-34319# American Univ., Washington, D.C. Dept. of Chemistry.
THE ROLE OF CHLORIDE ION IN CORROSION. PART 1: A BIBLIOGRAPHY ON THE CORROSION OF IRON AND STEEL IN HALIDE MEDIA Final Report, 15 Jun. 1966–31 Aug. 1968
R. T. Foley, David Goldberg, and Richard C. Carlston (Office of Naval Res., Washington, D.C.) Oct. 1968 32 p refs
(Contract N00014-66-C-0225)
(AD-686481) Avail: CFSTI CSCL 11/6

As part of an experimental investigation of the role of complex halide ions in corrosion, an extensive bibliography on halide assisted corrosion of iron and aluminum was developed. The references presented here deal with iron and steel exclusive of stainless steels or highly alloyed steels. For Part 2, see N69-33092. Author (TAB)

N69-34334# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
STAINLESS STEEL CLADDING DEVELOPMENT Quarterly Progress Report for Period Ending 31 Dec. 1968
William E. Ray Feb. 1969 29 p refs
(Contract AT(30-1)-3791)
(WARD-3791-29) Avail: CFSTI

Tensile test and biaxial stress rupture tests were conducted on Type 316 stainless steel tubing at 850, 1000, and 1200°F. The biaxial stress rupture data were compared with other available data. Data obtained on micro-peened tubing revealed improvements in short-time mechanical properties. A program involving the characterization of tubing processed by planetary swaging was planned. Under Task SSAA-310, preliminary examination of a stress-rupture specimen revealed intergranular as well as secondary transgranular cracks. Sensitization studies were initiated using the temperature range 750 to 1650°F for times up to 5000 hours. Author (NSA)

N69-34364# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ULTRASONIC VELOCITIES AND CRITICAL-ANGLE-METHOD CHANGES IN IRRADIATED 304 STAINLESS STEEL
D. O. Hunter Mar. 1969 48 p refs
(Contract AT(45-1)-1830)
(BNWL-1012) Avail: CFSTI

Ultrasonic critical-angle-method amplitude changes and ultrasonic shear and longitudinal velocities changes were measured on reactor irradiated AISI 304 stainless steel. For specimens irradiated at temperatures between 140 and 350°F, shear velocity

decreased from about 0.1% at 1.5×10^{18} nvt > 1 MeV to about 1.25% at 1×10^{20} nvt > 1 MeV; longitudinal velocity decreased from about 0.1% to 0.5% for the same neutron fluences. Measurements of velocities changes for specimens irradiated at temperatures between 610 and 680°F were inconclusive due to the small changes. There were indications, however, that high temperature irradiated specimens had experienced increased velocities before decreasing velocities trends were established. The trends of critical-angle-method amplitude changes, as functions of irradiation parameters, were generally comparable to the trends of velocities changes. Apparent changes in elastic constants were calculated by using measured changes in density and in shear and longitudinal velocities. Author (NSA)

N69-34385# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

KINETICS OF METAL FAILURE UNDER CYCLICAL LOADS

T. A. Lebedev et al Dec. 1968 23 p refs Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (USSR), No. 282, 1967 p 33–42

(AD-687229; FTD-MT-24-366-68) Avail: CFSTI CSCL 11/6

A brief review of the work on metal fatigue and metal failure carried out over the past 15 years is presented. In particular, the results on metal failure obtained by employing an experimental method are discussed; the method used consisted of measuring the magnitude of bending in rotating cantilever specimens as a function of a continuously increasing applied cyclic load. Graphs showing typical experimental results are presented. Author (TAB)

N69-34415# Michigan State Univ., East Lansing. Dept. of Physics.

A STUDY OF VACANCIES IN TUNGSTEN QUENCHED IN SUPERFLUID HELIUM

Ronald Joseph Gripshover 10 Apr. 1969 103 p refs

(Contract AT(11-1)-1247)

(COO-1247-17) Avail: CFSTI

A system was constructed that permits the refractory bcc metals to be annealed and quenched in the ultrapure conditions which exist in and directly above superfluid helium. Studies were made on vacancies quenched into fine tungsten wires and the subsequent annealing away of this quenched-in resistance. To determine the effective vacancy formation energy, E^v_f, tungsten specimens are quenched from temperatures between 1500° and 3200°K. By extrapolating the data to infinite quench speed, the equilibrium vacancy resistance is estimated. To study the annealing away of the quenched-in resistance, both isochronal and isothermal anneals were performed. Isothermal anneals with change-of-slope measurements yield an effective motion energy of 1.5 ± 0.3 eV. This estimate of the effective motion energy is in good agreement with the estimate obtained from the Flynn theory analysis; however, the data do not appear to be consistent with either Q = 6.6 eV, or with $E^v_f m$ = 3.3 eV obtained from recent radiation damage studies. Author (NSA)

N69-34418# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INCREASING THE STRENGTH OF COPPER-ALLOY WIRE

V. N. Fedorov and M. V. Zakharov Mar. 1969 11 p refs Transl. into ENGLISH from Elektrotekhnika (USSR), v. 37, no. 10, 1966 p 41–44

(AD-687238; FTD-HT-23-1086-68) Avail: CFSTI CSCL 11/6

A study was made of alloys of copper with various additions which improved the strength of small-diameter copper wire without substantially lowering its electrical conductivity. Recommendations are made with respect to the heat treatment of these alloys. Author (TAB)

N69-34427# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

ULTRASONIC PROPERTIES MEASUREMENTS ON IRRADIATED MATERIALS

O. O. Hunter 19 Nov. 1968 24 p refs Presented at the Remote Handling and Exam. in the Fast Reactor Field Meeting, Idaho Falls, Idaho

(BNWL-SA-2206; CONF-680305-4) Avail: CFSTI

Remote ultrasonic measurements have been made on irradiated steel. Results on specimens irradiated at temperatures less than 350°F indicate a fluence dependency. Results for some 304 specimens irradiated at 700 to 1000°F also indicate a fluence dependency but must be considered preliminary. Ultrasonic methods appear potentially useful in assessing the nature of radiation damage and recovery in steel specimens. Author (NSA)

N69-34438# Reactive Metals, Inc., Ashtabula, Ohio.

NPR UPSET-FORGING, LABORATORY PRESS, SURFACE OXIDATION OF URANIUM REDUCED OVERSTOCK, AND PRECISION EXTRUSION Semiannual Progress Summary, Jul.–Dec. 1968

21 Feb. 1969 37 p refs

(Contract AT(30-1)-1405)

(RMI-12) Avail: CFSTI

A 360 ton horizontal extrusion was obtained and installed in the laboratory. Natural, thermal, and chemical methods to oxidize the surface of a machined U billet were examined. The chemical method improves the quality of the as-extruded or as-forged U surfaces. Tests on reduction of machining overstock left on the OD and ID were conducted on the Mark 30A, C, and D sizes. Development of a precision extrusion process for the Mark 30A and B sizes is proceeding on schedule. NSA

N69-34439# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF MOLYBDENUM DISULFIDE ADDITIVES ON THE FATIGUE STRENGTH OF PARTS WITH ELECTROLYTIC IRON COATINGS

V. K. Andreichuk et al 26 Feb. 1969 7 p refs Transl. into ENGLISH from Elektron. Obrabotka Materialov, An MoldSSR, Inst. Prikl. Fiz. (USSR), no. 6, 1966 p 68–69

(AD-687239; FTD-HT-23-1110-68) Avail: CFSTI CSCL 11/8

Work is reported which established that the introduction into chlorine iron-plating electrolytes of molybdenum disulfide additives within the limits of 1.5 to 9 g/l practically does not lower the endurance limit of iron specimens, and therefore is not an obstacle for the restoration of parts which work under repeatedly variable loads. Author (TAB)

N69-34476# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.

DEFORMATION AND FRACTURE BEHAVIOUR OF ZIRCONIUM HYDROGEN ALLOYS Final Technical Report

M. R. Warren (Birmingham Univ.) and C. J. Beevers (Birmingham Univ.) 1969 38 p refs

(TRG-1793(c/x); HWR-FEMWG/P(68)365) Avail: CFSTI; UK

Zr–H alloys containing 25, 50 and 100 ppM H were tested at various temperatures at a strain rate of 5×10^{-4} sec^{-1}. Two distinct stages in the fracture of the hydride platelets could be distinguished: Stage I, the nucleation of cracks transverse to the major dimensions of the platelets; and Stage II, the formation of in-plane cracks which propagate in directions parallel to the major dimensions of the platelets. Stage I was related to the intersection of the platelets by matrix twins and slip bands and as such it exhibited both stress and strain control. A mechanism for transfer from State I to Stage II was set up, and it was

demonstrated that State II was not achieved until the spacing of the transverse cracks was of the order of the platelet thickness. During State II the initial formation of the in-plane cracks was apparently controlled by a normal stress condition, but growth during a later part of this stage was closely related to the overall plastic strain of the material. Author (NSA)

N69-34512# Oak Ridge National Lab., Tenn.
PREPARATION OF IRON-THORIA AND IRON-ALUMINA CERMETS BY A SOL-GEL METHOD
F. J. Smith and N. A. Krohn 25 Feb. 1969 15 p
(ORNL-TM-2518) Avail: CFSTI

Iron–thoria and iron–alumina cermets were prepared by mixing oxide hydrosols of the components, gelling them, and reducing the iron oxide with hydrogen. After compaction by usual metallurgical techniques, thermal conductivity and hardness were measured. Although several compositions failed to give coherent compacts, it is concluded that this is a feasible method of preparing cermets of dispersion hardened metals. Author (NSA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-33205# Army Weapons Command, Rock Island, Ill. Science and Technology Lab.
SYNTHESIS OF FLEXIBLE AROMATIC AND ALIPHATIC POLYSULFONE RUBBER
Lynn G. Widenman Apr. 1969 16 p refs
(AD-687257; RIA-69-101) Avail: CFSTI CSCL 11/10

A poly (alkylsulfone) was prepared from an ethylene-propylene sulfide copolymer and from poly (ethylene sulfide). These polysulfones had no elastomeric properties. A commercial polysulfone thermoplastic molding resin and vinylidene fluoride/hexafluoropropene elastomer were blended in solution. A vulcanizate of the resulting material showed better retention of properties at elevated temperatures than did the fluorinated elastomer. Polysulfonates and polysulfonamides investigated were resins. Author (TAB)

N69-33206# Army Weapons Command, Rock Island, Ill.
IMPROVING THE EFFICIENCY OF BONDED SOLID FILM LUBRICANTS
George Murphy, Jr. Mar. 1969 24 p refs
(AD-687256; RIA-69-635) Avail: CFSTI CSCL 11/8

The areas where resin bonded solid film lubricants are deficient were studied. These areas were, (1) finite wear, (2) ineffectiveness caused by contamination by conventional lubricants, and (3) decreased corrosion protection under dynamic conditions. The following conclusions may be derived from the data obtained. A resin bonded solid lubricant coating containing MoS_2 whose particle size is less than 0.5 microns, when vacuum impregnated into a porous bearing material, increased wear life by a factor of seven, as compared to standard application techniques. The ineffective lubrication by bonded solid film lubricants when contaminated by conventional lubricants was not remedied by making it more difficult for the oil to penetrate the coating. The corrosion preventive properties of the bonded solid film lubricant coating, tested under dynamic conditions, was greatly improved by increasing the coating thickness. Author (TAB)

N69-33221# France. Ministere De L'Air, Paris.
CONTRIBUTION TO THE OPTICAL STUDY OF THIN COATINGS [CONTRIBUTION A L'ETUDE OPTIQUE DES COUCHES MINCES]
Pierre Lostis (Ph.D. Thesis) 1968 71 p refs In FRENCH
(NT-162) Avail: CFSTI

Different analytical methods of determining certain optical properties of thin coatings with complex indices of refraction and thickness) were reviewed. In the first part, new experimental devices for the measurement of oblique incidence, the goniolndexmeter and the electronic goniospectrophotometer were demonstrated using a palladium coating of a single layer where thickness did not influence optical factors. In the second part, experimental devices are described which permit the measurement of constant indices which include the thickness function. Calculations of several mixed palladium coatings, i.e., palladium and zinc sulfate, provide relationships of chemical concentration factors as they relate to optical factors. Graphical and numerical methods for deriving the complex index in the case of a single layer coating and multilayer coatings are indicated. Transl. by M.H.E.

N69-33231# Army Weapons Command, Rock Island, Ill. Science and Technology Lab.
SYNTHESIS OF CARBONATE AND AMINE MODIFIED POLYETHER ELASTOMERS
Richard A. Faoro Mar. 1969 18 p refs
(AD-687252; RIA-69-104) Avail: CFSTI CSCL 11/10

Oil-resistant block copolymers were synthesized by the copolycondensation of polyether polyols and compounds of the bisphenol type of structure with phosgene. Sulfur - and peroxide-cured vulcanizates of these polyether glycols (0.70 to 5.12 percent mole unsaturation) and 2,2-bis(4-hydroxyphenyl) propane (Bisphenol A) and its derivatives exhibited tensile strengths up to 1540 psi, 31 percent volume swell after immersion in ASTM 3 oil for 70 hours at 212F, and flexibility at temperatures below -67F. Elastomers resulting from the reaction of liquid amine-terminated polytetramethylene oxides and various diepoxides exhibited poor flexibility at low temperatures and poor resistance to oil. Author (TAB)

N69-33234# Army Weapons Command, Rock Island, Ill. Science and Technology Lab.
URETHANE-UREA ELASTOMERS FOR LOW-TEMPERATURE, OIL AND FUEL RESISTANT APPLICATIONS
Wilbur M. Veroeven Mar. 1969 18 p refs
(AD-687255; RIA-69-102) Avail: CFSTI CSCL 11/10

Millable polyether urethane-urea elastomers having good low-temperature flexibility and oil resistance were prepared on a semiplant scale and evaluated. These elastomers were also compounded and evaluated in specific end-item applications. Results showed that semiplant quantities and scaled-up processing methods can duplicate results obtainable on a laboratory scale. These elastomers had poor resistance to fuels high (40 percent or greater) in aromatic content. Various thioether, chloro-substituted ether, and pyridyl modified glycols were evaluated in urethane-urea millable gum preparation to improve aromatic fuel resistance while retaining desirable properties such as low-temperature flexibility and tensile strength. Thioethers offer considerable promise; but further work with thioethers, chloro - and fluoro-substituted ethers,

and various glycol blends is considered necessary before the potential and the shortcomings of these materials, in preparation of a fuel-resistant elastomer, can be realized. Author (TAB)

N69-33236*# Battelle Memorial Inst., Columbus, Ohio. Radiation Effects Information Center.
THE EFFECT OF RADIATION ON ELECTRICAL INSULATING MATERIALS
C. L. Hanks and D. J. Hamman 16 Jun. 1969 59 p refs
(Contract NASw-1568)
(NASA-CR-101129; REIC-46) Avail: CFSTI CSCL 11G

Compiled and summarized are information available on the effects of steady-state radiation on electrical insulating materials. The insulating materials are classified as organic or inorganic with separate sections on bulk type specimens (film, sheet, etc.), wire and cable insulation, encapsulating compounds, and connectors and terminals. It is the intent of the report to provide information for ballpark or broad estimates of the effect of radiation on various insulating materials and is meant to be used as a guide in the early design stages. Detailed information as required in the terminal stages of design should be requested when details of all environmental conditions, radiation exposure rate, and total dose are known. Author

N69-33239# Naval Research Lab., Washington, D.C.
FLUOROCARBON IN EPOXY PLASTICS Interim Report
James E. Quick and James R. Griff Apr. 1969 16 p refs
(AD-686652; NRL-6875) Avail: CFSTI CSCL 11/9

Some epoxy plastic components (resins and curing agents) have been synthesized which contain fluorocarbons in their molecular structures. In some cases the fluorocarbon is part of the network structure upon which the strength of the plastic depends, and in all cases it is attached to the network by at least one covalent chemical bond. Among the properties that are obtained with selected resin systems are surface nonwetting by water, low internal absorption of water, and low surface friction of the cured plastics. In specific cases, low-melting or liquid resin systems have been obtained which react upon the application of heat to yield plastics. Author (TAB)

N69-33240# Explosives Research and Development Establishment, Waltham Abbey (England).
RESISTANCE OF RUBBERS TO TROPICAL AND TEMPERATE CLIMATES
D. J. Evans, B. L. Hollingsworth, K. J. Ledbury, and A. L. Stokoe Jan. 1969 28 p
(AD-687223; ERDE-10/R/68) Avail: CFSTI CSCL 11/10

Seven rubbers, fluorinated rubber, neoprene ILA, PVC/nitrile rubber blend, ethylene/propylene/diene terpolymer, natural rubber, neoprene WRT and nitrile rubber, have been exposed outdoors in a stressed and unstressed condition on four sites - a temperate site and three tropical sites (hot/wet cleared, hot/wet jungle and hot/dry desert). The tensile strength, elongation at break and modulus were measured after 3, 6, 12 and 27 monthly intervals. The results show that ethylene/propylene/diene terpolymer, Viton and neoprene WRT were the least affected by exposure to temperate and tropical conditions. Author (TAB)

N69-33318*# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF THE KINETICS OF CRYSTALLIZATION OF MOLTEN BINARY AND TERNARY OXIDE SYSTEMS Quarterly Status Report
James F. Bacon 1 Aug. 1969 29 p refs
(Contract NASw-1301)
(NASA-CR-101134; HS10373-15; QSR-15) Avail: CFSTI CSCL 11B

Thirty-two new glass compositions were conceived, prepared and partially characterized in this period. Similar characterization studies were completed for some of the compositions reported earlier and these include density, Young's modulus, and fiberizability determinations. In addition, one of the two commercial-type platinum-20% rhodium single hole glass fiber bushings was installed and used to produce "E" glass for strength determinations on pristine fibers. A total of a dozen glass compositions were developed with values for Young's modulus measured on bulk samples greater than twenty million pounds per square inch and another dozen have values for Young's modulus between nineteen and twenty million psi. The best of these appears to be an invert analog glass, UARL 383, with a Young's modulus of 22.75 million pounds per square inch, a specific modulus of 200 million inches, and with no toxic ingredients. The best data for the experimental glasses actually measured on fibers of that glass is a Young's modulus of 19.8 million pounds per square inch for UARL 331. Author

N69-33321*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FAILURE CRITERIA FOR FILAMENTARY COMPOSITES
Christos C. Chamis Washington Aug. 1969 32 p refs
(NASA-TN-D-5367) Avail: CFSTI CSCL 11D

A two level, linear, semiempirical theory for a failure criterion is described. The theory predicts the strength behavior of unidirectional filamentary composites under uniaxial and combined stress from basic constituent material properties and fabrication process considerations. Applications of the theory to several filament nonmetallic matrix composites are presented and comparisons are made with experimental data. These results show good agreement between theory and experiment. Simple and combined strength envelopes are generated to illustrate the versatility of the theory and to point out problem areas in experimental work and design. Author

N69-33448*# Illinois Univ., Urbana. Coordinated Science Lab.
INVESTIGATION OF THE LUMINESCENT PHENOMENA OF HIGH RESISTIVITY SILICON AND STUDY OF ELECTRICAL CHARACTERISTICS OF TUNNELING INTO LOW RESISTIVITY SILICON Semiannual Progress Report, 20 Sep.-20 Mar. 1969
W. Dale Compton 15 Apr. 1969 32 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952383)
(NASA-CR-103845; SAPR-1) Avail: CFSTI CSCL 11B

Although substantial progress was made, measurements are still in progress and final conclusions are not possible at this time. The areas of research are: (1) the study of the influence of uniaxial stress and temperature upon the high resolution luminescence spectra of electron irradiated silicon; (2) the study of the effects of lithium dopant upon the spectra of the recombination luminescence of irradiated silicon; (3) the thermal stability of the defects that are responsible for the recombination luminescence in irradiated silicon; and (4) the influence of irradiation upon the electron tunneling characteristics of highly doped silicon. Author

N69-33448*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TENSILE CREEP-RATE STUDIES ON PYROLYTIC CARBON
D. B. Fischbach 15 Jul. 1969 25 p refs
(Contract NAS7-100)
(NASA-CR-103846; JPL-TR-32-1388) Avail: CFSTI CSCL 11B

The parallel-to-substrate tensile creep behavior of an as-deposited (2200°C), substrate-nucleated, pyrolytic carbon was

investigated over the temperature range 2500–2900°C and the stress range = 5000–30,000 psi under deadweight loading. A stress-change technique was combined with a graphical-interpolation analysis to obtain data on the stress σ and temperature T dependence of the creep rate $\dot{\epsilon}$ over broad strain ϵ and stress or temperature ranges on individual specimens. These data were used to determine the stress exponent n and the activation energy ΔH in the empirical expression $\dot{\epsilon} = A\,\sigma^n \exp(-\Delta H/RT)$. Two distinct deformation regimes were confirmed. After 1-2% gage elongation, an increase in $\dot{\epsilon}$ indicated a change in deformation mechanism. In the same range, n dropped from an initial value of ~4 to 1.5 ±0.4. During the first 8% elongation, several changes occurred in structure and properties. A density increase of~2% and a large increase in Young's modulus were produced by the graphitization and preferred orientation increase that occur in this range. The reduction in area showed that, aside from the graphitization volume decrease, the deformation occurred at constant volume to at least 30% elongation. Author

N69-33483*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INORGANIC THERMAL CONTROL COATINGS
Albert C. Krupnick, inventor (to NASA) Filed 3 Apr. 1969 15 p
(NASA-Case-MFS-20011; US-Patent-Appl-SN-813338) Avail: CFSTI CSCL 11C

The optical properties of the coatings are adjusted to provide for maintenance of temperatures within prescribed limits by means of reflection or absorption of solar energy. The coatings were invented for application to exposed surfaces of spacecraft components but are also suitable for terrestrial applications. The compositions of the coatings are based on a binder obtained by gelling a suspension of synthetic mica or sodium magnesium fluorolithosilicate mineral with a solution of a soluble metal silicate or sulfate. Pigments and other additives are included to provide the desired optical properties. For solar reflector coatings, zinc oxide pigment and hollow glass microspheres are used. A suggested method for applying the coatings is spraying followed by curing between 170° to 250°F. NASA

N69-33573# Eidgenossische Technische Hochschule, Zurich (Switzerland).
TECHNOLOGICAL STUDY COMPARING SOLDERING ELECTRODES ALLOYED BY COATING AND BY WIRE [ETUDE TECHNOLOGIQUE COMPAREE DES ELECTRODES DE SOUDAGE ALLIEES PAR L'ENROBAGE ET ALLIEES PAR LE FIL]
Jean-Pierre Voiret (Ph.D. Thesis) 1968 114 p refs In FRENCH *Its* These No. 3999
Avail: CFSTI

A comparison of soldering and metal transport of two electrodes based on manganese and molybdenum is given. Tests were performed on type AF wire for alloy elements, and the coating process on type AE wire. Results show the properties of soldering holds for the chemical, mechanical, and metallographic properties of the metal deposits. Trans. by E.H.W.

N69-33604*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS OF TESTS FOR ADHESION IN AIR AND IN VACUUM OF TITANATE COATINGS APPLIED TO 321-STAINLESS-STEEL BRAYTON PARASITIC-LOAD RESISTORS
Jack H. Shank Jun. 1969 24 p refs
(NASA-TM-X-52629) Avail: CFSTI CSCL 11C

Tests were run to determine the adhesion of a high-emissivity plasma-sprayed coating of either iron titanate or calcium titanate to the 321-stainless-steel surface of the Brayton Parasitic Load Resistor during operation of the Parasitic Load Resistor in air and in a vacuum in the temperature range of 1700° R to 2000° R. Iron titanate did adhere during operation in a vacuum, but iron titanate did not adhere during operation in air. Calcium titanate adhered during operation both in a vacuum and in air. Author

N69-33779# Massachusetts Univ., Amherst. Dept. of Chemistry.
THE DETERMINATION OF THE INHOMOGENEITY OF CROSSLINKING OF A RUBBER BY A LIGHT SCATTERING
Richard S. Stein May 1969 9 p refs
(Contract Nonr-3357(01))
(AD-687468; ONR-TR-116) Avail: CFSTI CSCL 11/0

By extending the theory of Flory and Rehner for the swelling of a crosslinked network which is inhomogeneously crosslinked, it is predicted that local fluctuation in degree of swelling will occur which will lead to fluctuations in refractive index. By utilizing the Debye-Bueche theory of scattering, it is shown that this will lead to enhanced scattering. The analysis of this scattering permits one to evaluate the mean squared fluctuation in crosslinked density as well as the size of the regions within which fluctuations occur. Author (TAB)

N69-33785# Sandia Corp., Albuquerque, N.Mex.
PHYSICAL PROPERTY CHARACTERIZATION OF 3.0 AND 6.0 LB/CU FT CARBON FOAMS
Peter B. Rand Dec. 1968 36 p ref
(PB-182942; SC-DR-68-793) Avail: CFSTI CSCL 11B

Because of its temperature resistance, carbon foam has been proposed for use as a structural support material for various components used in weapon systems. This report concerns the development of static and dynamic physical property tests for qualification and physical property definition of these materials. The brittle nature of carbon foam and associated surface fragility indicated the need for new test techniques. Author (USGRDR)

N69-33786# Army Weapons Command, Rock Island, Ill. Science and Technology Lab.
DEVELOPMENT OF SMALL ARMS LUBRICANTS
Elmer I. Spearman Mar. 1969 16 p refs
(AD-687251; RIA-69-689) Avail: CFSTI CSCL 11/8

Samples of materials containing organic chlorides, phosphates, phosphites, sulfides or a combination of one or more of these compounds were obtained for screening tests to determine the relative effectiveness of these materials as anti-wear additives for mineral oil base lubricants. Author (TAB)

N69-33793# Gulf General Atomic, San Diego, Calif.
RESEARCH ON GRAPHITE Quarterly Progress Report for Period Ending 14 Feb. 1969
J. C. Bokros, G. B. Engle, and R. J. Price 19 Feb. 1969 29 p refs
(Contract AT(04-3)-167)
(GA-9239) Avail: CFSTI

Grinding experiments were conducted on various graphites to determine the extent of pore removal. Compacts prepared from a petroleum-asphalt coke containing aluminum, titanium, or a combination of the two were heated for longer periods at 2100 or 2300°C. The specimens containing Al continued to convert to graphite, while the Ti-doped materials showed only traces of graphitic structure. Graphite compacts prepared with needle-coke particles and various amounts of binder coke have been irradiated at 1225 to 1250°C. A series of anisotropic and near-isotropic graphites were irradiated at 1000 to 1250°C. Samples of highly oriented, single phase-carbons and graphites are being irradiated to determine the radiation effects. Samples of hot-worked graphite, as-deposited

massive pyrocarbon, and annealed massive pyrocarbon irradiated at 750 to 800°C and at 1250 to 1290°C have been examined and results given. NSA

N69-33802# Sandia Corp., Albuquerque, N.Mex.
CHARACTERIZATION OF CARBON FABRICS AND FILAMENTS, CARBONIZING RESINS, CARBON-CARBON COMPOSITES, AND PROCESSING TECHNIQUES
H. A. MacKay Apr. 1969 30 p refs
(SC-RR-68-651) Avail: CFSTI

The properties of the carbon–carbon composite laminate are dependent on the type, composition, and orientation of the carbon or graphite reinforcement; the initial carbonizing resin binder; and certain processing parameters. The resin char yield after carbonization ranges from 15 to 85 percent; the phenolics and epoxylated novolacs provide 60-percent residual carbon. Carbon and graphite fabrics or yarns with no previous history of phosphorous flame retardant additives are recommended as reinforcements because they maintain fiber identity in the composite after carbonization. When carbonized at 1550°F, carbon–carbon laminates composed of a 60-percent carbon char forming resin and a square weave 99 percent carbon fabric show weight losses of 16 to 20 percent. After three reimpregnations with oxalic acid catalyzed furfuryl alcohol and three recarbonization cycles, these laminates retain 60 to 100 percent of noncarbonized control mechanical property values from 75° to 900°F. Author (NSA)

N69-33820# Royal Aircraft Establishment, Farnborough (England).
HEAT STABILITY IN FLUOROSILICONES
D. K. Thomas Sep. 1968 28 p refs
(RAE-TR-68234) Copyright. Avail: CFSTI

Fluorosilicones are less heat stable than conventional silicones because they are more likely to revert to low molecular weight cyclic products and they are more susceptible to oxidation. Reversion is promoted by base catalyst residues from the polymerisation process, but the effect can be minimised by the use of compounding ingredients and vulcanising reagents. Oxidation leads to cross-linking and in certain circumstances this can mask the effects of reversion, in practice this high rate of cross-linking will often be a disadvantage and should be suppressed by the use of chemical additives. Author (ESRO)

N69-33822# Stevens Inst. of Tech., Hoboken, N.J.
COLD DRAWING IN CRYSTALLINE POLYMERS
R. D. Andrews Natick, Mass. Army Oct. 1968 57 p refs
(Contract DA-19-129-AMC-1001(N))
(AD-687339; TR-69-42-CE) Avail: CFSTI CSCL 11/9

In this investigation of the plastic yield (or cold-drawing) phenomenon in crystalline polymers, most of the work was carried out on Nylon 6, although polyethylene terephthalate (PET), polyacrylonitrile (PAN) and polyvinyl chloride (PVC) were also studied. Absorption of plasticizers (water, alcohols, phenol) in Nylon 6 produced changes in the crystalline structure as well as plasticizer action; these two effects must therefore be carefully distinguished. Changes in the crystalline structure were followed by changes in the infrared spectrum. Dynamic mechanical and thermogravimetric analysis (TGA) measurements were carried out on the polymer before and after treatment. Phenol treatment produces a total disappearance of the yield peak in the stress-strain curve and a simultaneous disappearance of neck formation. The drawing of amorphous PET was studied under dead-load creep conditions. Creep drawing of plasticized PVC was also measured. Measurements were made of the temperature dependence of orientation birefringence in PVC containing different amounts of plasticizers (dioctyl phthalate, dioctyl adipate, tricresyl phosphate). The different plasticizers produced very different effects in this type of experiment. TAB

N69-33830# American Science and Engineering Inc., Cambridge, Mass.
INVESTIGATION OF THE SOLUBILITY OF REFRACTORY OXIDES IN FUSED MELTS, THE DUGGER CRYSTAL GROWTH TECHNIQUE, AND FACTORS INFLUENCING THE GROWTH OF Be SUB 2 Ge-O SUB 4 Final Report, 22 Aug. 1966–21 Oct. 1968
Carolus M. Cobb and Elbridge B. Wallis Mar. 1969 76 p refs
(Contract F19628-67-C-0013)
(AD-687497; ASE-2213; AFCRL-69-0128) Avail: CFSTI CSCL 11/2

Theoretical equations for predicting the solubility of refractory oxides in molten fluxes were developed. These equations relate oxide solubility to three thermodynamic parameters of the pure oxide; the temperature of melting, the heat of melting, and the difference in the heat capacities of pure liquid and solid oxide. Effects of the flux upon the oxide solubility have been related to the partial molar heat of mixing of the oxide in the flux for simple systems and to generalized thermodynamic activity coefficients for complex systems. Equations for predicting the change of solubility with temperature were derived. Studies on the Dugger flux growth method did not proceed beyond the stage of experimental planning. A tentative phase diagram for the beryllium germanate system was experimentally determined. The implications of these phase relationships on the selection of crystal growth techniques for beryllium germanate have been discussed and a potential flux method of growth described. Results from the Program indicate that theoretical techniques can be usefully applied to predicting solubility relationships during the crystal growth of refractory oxides from fluxes; the Dugger flux growth technique may be the first reported example of precipitation from an homogeneous flux solution; crystal growth of beryllium germanate must be attempted by flux growth techniques. Author (TAB)

N69-33868# Royal Aircraft Establishment, Farnborough (England).
THE TIME-DEPENDENCE OF ULTIMATE PROPERTIES IN RUBBERS
D. K. Thomas and B. B. Moore Sep. 1968 27 p refs
(RAE-TR-68235) Copyright. Avail: CFSTI

The principles of time-temperature superposition have been applied successfully to the ultimate properties of filler-reinforced non-crystallising rubbers. By utilising the relation between ultimate strain and reduced strain rate it is possible to construct 'tensile failure bands' in which the maximum and minimum time to failure is shown as a function of initial stress or strain. These results are only applicable to rubbers under uniaxial tensile stress. Author (ESRO)

N69-33874# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ELASTIC BEHAVIOR OF ARC-CAST ZIRCONIUM CARBIDE-GRAPHITE ALLOYS, SEPTEMBER 1965–SEPTEMBER 1967
Ronald C. Rossi, Robert D. Carnahan, and K. R. Janowski Jan. 1969 21 p refs
(Contract F04701-68-C-0200)
(AD-687437; TR-0200(4250-10)-4; SAMSO-TR-69-121) Avail: CFSTI CSCL 11/2

The Youngs modulus and shear modulus of arc-cast zirconium carbide-graphite alloys were measured as a function of graphite content and were found to be dependent upon the microstructure of these alloys. Attempts to fit several theoretical analyses to the data were not successful. The simplified physical models from which these analyses were derived limit their usefulness in predicting elastic behavior for materials having complex microstructures. Author (TAB)

N69-33877# Rocket Propulsion Establishment, Westcott (England).
SOME APPLICATIONS OF CARBONS AND GRAPHITES IN SPACE TECHNOLOGY
A. C. Parmee 1969 13 p refs Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 9–11 Apr. 1969
Copyright. Avail: CFSTI; HMSO

A variety of new and improved forms of carbon and graphite are described in terms of their method of manufacture and properties. Some of the applications of these materials in aerospace technology are indicated and particular reference is made to pyrolytic carbon and its application in uncooled rocket nozzles and re-entry shields. Author (ESRO)

N69-33986•# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MAGNETIC PROPERTIES OF SELECTED SPACECRAFT MATERIALS
P. W. Droll and E. J. Iufer *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 189–197 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 11D

This paper summarizes the results of an investigation of the magnetic properties of selected spacecraft materials. Experimental measurements describing the effects of magnetic field exposure, shock, vibration, and temperature on the induced and remanent dipole moment of Kovar, Dumet, Invar, Nickel, 304SS, 410SS, and 416SS rod specimens are presented. Analysis of the data indicates that temperatures of 77°K to 390°K, shock to 50 g, and vibration to 25 g produce negligible effects on dipole moment for specimens having length-to-diameter ratios of 5.5. By means of the data provided, predictions of the dipole moment can be made for these materials if the alloy, demagnetization factor, magnetizing field, volume, and length-to-diameter ratio are known. Author

N69-33983# Bristol Aerojet, Ltd., Banwell (England).
CARBON FIBRE COMPOSITES IN ROCKET MOTOR SYSTEMS
T. A. Trigg Mar. 1969 21 p refs Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 9–11 Apr. 1969
Avail: CFSTI

Although carbon is contained in around 90% of all known chemical compounds, it has only recently had any marked effect as a structural material. This has been made possible by the discovery that certain synthetic polymeric fibres can be reduced to pure carbon or graphite with attractive mechanical properties and that these can subsequently be used for reinforcing composite materials. In rocket motor structures many of the applications call for materials that will withstand high temperatures and in this direction increasing use is being made of carbon/resin materials as ablative liners. These have been shown to have improved properties over more conventional asbestos/resin materials, with an added bonus of weight advantage. The recent introduction of high modulus carbon fibres into the resin composite technology has given impetus to the development, particularly in the area of rocket motor case manufacture. Although mechanical performance data is still limited, there is sufficient evidence to indicate that the basic weight of an unfilled motor and expansion cone may be halved by use of carbon fibre composites to the exclusion of all conventional materials. Author (ESRO)

N69-34008# Naval Ordnance Lab., White Oak, Md.
CALCULATION OF TEMPERATURE HISTORIES IN ABLATING MATERIALS
Bruce Hartmann Aug. 1968 48 p
(AD-687708; NOLTR-68-107) Avail: CFSTI CSCL 11/7

An analysis of the temperature distribution in an ablating material was made and programed for a digital computer. The basic experimental information needed for the computer program is the effective thermal diffusivity and ablation rate of the material. Parametric studies with the program show that the temperature profile is not sensitive to the temperature variation of the effective thermal diffusivity, but it is sensitive to the time variation of the ablation rate. Experimental verification of the analysis was carried out using an oxy-acetylene burner. It was found that the calculated time to reach 200C agreed with the expeimental time to within 7%, provided steady-state ablation was reached. If steady-state was not reached, there was a very large error. The overall conclusions from this work are that the combination of the analysis, the computer programing, and the experimental procedures are sufficiently accurate under the test conditions used to serve as a guide in the design and selection of materials for ablation applications. Author (TAB)

N69-34024# Royal Aircraft Establishment, Farnborough (England).
MASS SPECTROMETER ANALYSIS AND TENSILE TESTING OF IRRADIATED MATERIALS FOR SATELLITE APPLICATIONS
T. N. Williams Aug. 1968 21 p refs
(RAE-TR-68218) Avail: CFSTI

Three types of sheet plastic material and a quantity of 'Loctite' sealant, intended for use in satellites, were given an overdose of gamma irradiation whilst under vacuum. The quantity of outgassing was measured and the gas composition analysed using a mass spectrometer. The tensile strength of the plastic materials was also tested both before and after irradiation. Author (ESRO)

N69-34038# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
PREPARATION OF THIN FILMS
M. Vobecky and O. Dragoun Feb. 1969 12 p refs Transl. into ENGLISH from Jaderna Energie (Prague), v. 3, 1957 p 410–413
(UJV-2148-F) Avail: AEC Depository Libraries

Techniques for the preparation of thin films for use as Geiger-Mueller counter windows and as supports for radioactive sources are described. Materials studied include nitrocellulose, copolymer of vinylchloride and acetate, polystyrene, polyamide, polyvinyl-acetate, and polyvinylbutyrate. Author (NSA)

N69-34129# Union Carbide Nuclear Co., Oak Ridge, Tenn. Gaseous Diffusion Plant.
FOAM PLASTIC INSULATION FOR HIGH TEMPERATURE AND SHOCK PROTECTION
S. J. Wheatley and A. J. Mallett [1968] 26 p refs
(Contract W-7405-eng-26)
(K-L-6202; CONF-681127-1) Avail: CFSTI

The development and testing of packages which protect cylinders of uranium hexafluoride in case of fire or accident are described. Protective packaging was accomplished with the development of a fire and shock resistant phenolic plastic foam insulation produced by mixing an organic foaming agent with a liquid phenol-aldehyde resin having a viscosity of 2,200 to 3,000 centipoises at 25°C. Two acidic agents boric anhydride (B_2O_3) and anhydrous oxalic acid ($H_2C_2O_4$) help produce a stable foam. A silicone surfactant is used to promote uniform pore size and refrigerant-113 is employed as a blowing agent. The foam is corrosion resistant to acids, oil, and water. Nuclear safety was achieved with the addition of the boric anhydride B_2O_3. NSA

N69-34132# North Carolina State Univ., Raleigh.
FRACTOGRAPHIC AND THERMAL ANALYSES OF SHOCKED ALUMINA
H. Palmour, III, C. H. Kim, D. R. Johnson, and C. E. Zimmer Apr. 1969 108 p refs
(Contract N00014-68-A-0187; ARPA Order 1090)
(AD-687415; TR-69-5) Avail: CFSTI CSCL 11/2

This report is concerned with energy absorption processes in ceramic materials exposed to highly dynamic strains capable of causing fracture. Optical and electron fractographic analyses, and direct transmission electron microscopy, were employed in characterizing fracture in ballistically damaged sapphire single crystals and alumina ceramics. Impact fractures were compared with slow break fractures in bars cut from large polycrystalline fragments. Using electron microscopic and dynamic differential calorimetry techniques, explosively shocked alumina particulate also have been examined for evidences of residual strain and annealable excess energy. The findings produced many mutually supporting evidences of local plastic deformation and energy absorption associated with fracture processes in aluminum oxide ceramics and sapphire single crystals. Microscopic evidences from replication fractography, and particularly from direct transmission electron microscopy, strongly support the concept of localized plastic deformation processes associated with fracture. Exothermic energy releases observed during heating of explosively shocked materials over the range 800 1200C were estimated at least 14.6 cal/g. TAB

N69-34134*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURFACE TENSION, VISCOSITY, AND DENSITY MEASUREMENTS OF TWO FLUOROCARBON SOLVENTS, FC-43 AND FC-78
Thom A. Coney Washington Aug. 1969 11 p refs
(NASA-TM-X-1862) Avail: CFSTI CSCL 20D

The surface tension, viscosity, and density of fluorocarbon solvents FC-43 and FC-78 were measured as functions of temperature. A Du Noüy tensiometer, a falling ball viscometer, and a specific gravity chainomatic balance were used in the measurements. Liquid temperatures were varied from 5° to 30° C. Property values at 20° C were 16.7 dynes per centimeter, 6.49 centipoise and 1.9053 grams per cubic centimeter, for FC-43 and 13.2 dynes per centimeter, 0.62 centipoise, and 1.7290 grams per cubic centimeter, for FC-78. Author

N69-34160# Admiralty Materials Lab., Holton Heath (England).
THE FABRICATION AND PROPERTIES OF SILICON NITRIDE CERAMICS AND THEIR RELEVANCE TO AEROSPACE APPLICATIONS
D. J. Godfrey 1969 15 p refs Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 9–11 Apr. 1969
Avail: CFSTI

After briefly reviewing traditional ceramic fabrication methods, the production of silicon nitride ceramics is discussed and is followed by a description of recent developments which have increased its versatility, i.e. joining techniques used with silicon compacts before nitridation, compacting Si_3N_4 powder by pressure applied at very high temperatures etc. The properties of silicon nitride ceramics for aerospace applications are discussed. Both the hot-pressed and reaction-bonded types of silicon nitride ceramics have very low thermal expansion coefficients which makes their thermal shock resistance outstanding and a low density which make their strength/weight ratio attractive. Methods which allow for the veriability in mechanical properties of such ceramics by the use of statistically-derived safety factors are evolving, but the brittleness of these strong materials requires the application of a special design philosophy as stress concentration effects can be extremely troublesome. ESRO

N69-34210# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
SOUND ABSORPTION TESTS ON POLYURETHANE AND LIQUID SOAP FOAMS FOR ANECHOIC ENCLOSURES
G. Krishnappa, G. G. Levy, and G. A. Macaulay Feb. 1969 18 p refs
(AD-687919; NRC-10687) Avail: CFSTI CSCL 14/2

An investigation was made of the normal and random incidence absorption of samples of 2-in thick polyurethane foam selected for use in the construction of an anechoic enclosure for lifting-fan noise studies. Author (TAB)

N69-34222# Dayton Univ., Research Inst., Ohio.
STRUCTURAL AND ORIENTATIONAL ASPECTS OF GRAPHITIZED FIBERS Technical Report, May–Oct. 1968
Mark Goldschmit Wright-Patterson AFB, Ohio AFML Apr. 1969 34 p refs
(Contract AF 33(615)-3997)
(AD-687881; UDRI-TR-69-10; AFML-TR-69-53) Avail: CFSTI CSCL 11/5

A technique is described whereby the mutual orientation of the (001) planes of graphitized fibers might be measured. A two-circle goniometer in conjunction with the line focus of a copper X-ray source was used to carry out the measurements. A structure analysis was performed on the (002) line profiles of various fibers using a chromium X-ray source and gas-flow proportional counter. Comparisons are made of the (002) profiles obtained from a copper X-ray source and a chromium X-ray source. In both cases the radiation was unfiltered to insure maximum intensity. Author (TAB)

N69-34238# Atomic Weapons Research Establishment, Aldermaston (England).
FILAMENT WINDING. A CRITICAL SURVEY OF MATERIALS, PROCESSES, AND APPLICATIONS
D. O. Newling Dec. 1968 112 p refs
(AWRE-O-81/68) Avail: CFSTI; HMSO 15s

The development of the technique of producing filament wound reinforced plastics is described. The materials used are described, and a glossary of terms included. Author (NSA)

N69-34318# Lehigh Univ., Bethlehem, Pa.
STRENGTHENING MECHANISMS OF THERMOMECHANICALLY PROCESSED POLYCRYSTALLINE CERAMICS Final Report, 1 Jun. 1966–31 Mar. 1969
R. M. Spriggs May 1969 6 p refs
(Contract DA-31-124-ARO(D)-386; Grant DA-ARO(D)-31-124-G739)
(AD-688675; AROD-5720.9-MC) Avail: CFSTI CSCL 11/2

The report discusses the mechanisms of densification, deformation, and strengthening of pure and alloyed polycrystalline ceramic oxides prepared by hot forming techniques, e.g., hot pressing followed by press forging. Author (TAB)

N69-34360# Imperial Metal Industries (Kynoch), Ltd., Birmingham (England).
CARBON FIBRE REINFORCED PLASTIC COMPONENTS FOR AEROSPACE USE
M. W. Jones 1969 19 p refs Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 9–11 Apr. 1969
Avail: CFSTI

An outline is given of the development history of RAE carbon fibre reinforced plastics. Initially, development was inhibited by poor interlaminar shear strength. However, composite properties

have improved since the advent of various surface treatments derived by the fibre producers. Present work indicates certain criteria by which resins are selected for use as a matrix with the two available types of RAE fibre. These are more critical for filament wound cylindrical components than for pressed flat laminates, as shown by levels of fibre compaction achieved on hoop wound NOL rings and helically wound tubes. At present, the strength data fall well below that available if the full strength of the single fibre or bundle is utilised. However, the majority of the fibre stiffness has been achieved in unidirectional composites. Illustrations are shown of a carbon fibre reinforced plastic and honeycomb sandwich satellite structure which has been constructed to investigate the efficacy of methods selected for laminating polygonal cylindrical shapes, the subsequent adhesive bonding and the final machining to complete the structural assembly. Author (ESRO)

N69-34403# Royal Aircraft Establishment, Farnborough (England).
APPROXIMATE MEASUREMENTS OF SOME PHYSICAL PROPERTIES OF CARBON FIBRE REINFORCED POLYMERS, RELEVANT TO THEIR APPLICATIONS IN TRIBOLOGY
J. K. Lancaster May 1968 33 p refs
(RAE-TR-68123/UL) Copyright. Avail: CFSTI

Methods for the rapid determination of approximate values of the elastic modulus and its temperature variation, thermal conductivity and the coefficient of linear expansion for some carbon fiber reinforced thermoplastic polymers are described. Composites containing type 2 fibers are invariably stiffer at all temperatures than those incorporating type 1 fibers. At high carbon fiber contents, thermal conductivities can be more than a factor of ten greater than those of parent matrices, and the coefficients of expansion decrease to levels approximating those of metals. An attempt is also made to predict, from flash temperature theory, the maximum loads and speeds which can be used for polymer based composites sliding on steel. The results obtained are in reasonable agreement with experimental observation. Author

N69-34410# Danish Research Centre for Applied Electronics, Copenhagen (Denmark).
EMBEDDING MATERIALS: INVESTIGATION OF TWENTY SIX DIFFERENT MATERIALS FOR EMBEDDING OF ELECTRONIC CIRCUITS [INDSTOEBNINGSMATERIALER: EN UNDERSOEGELSE AF 26 MATERIALEVARIANTER TIL INDSTOEBNING AF ELEKTRONISKE KREDSLOEB]
S. T. Olesen Apr. 1969 44 p In DANISH; ENGLISH summary
Sponsored by Sammenslutningen for Palideligheds- og Miljoetek.
(ECR-05) Avail: CFSTI

This investigation comprises cold-curing liquid casting materials for embedment of electronic modules and components. Heat-curing materials and materials for pressure molding are not included. The purpose of the investigation is to examine the application parameters of some of the existing epoxy, polyester, and silicone materials, but as the number of such materials is extremely large, it has only been possible to include a fairly representative selection which can serve as example. Another purpose of the examination has been to investigate a number of test methods which are specially related to the applicabilities of the materials for electronic modules. The designer who has to choose a material for a given purpose will usually through the manufacturer get rather good information regarding the physical constants of the material. However, these constants often are of a limited use, as they seldom refer to the practical application factors in a simple way. As example the formation of cracking at low temperatures can be mentioned. This quality is in principle determined by tensile strength, elasticity module and coefficient of heat expansion of the casting material and the embedded object, but as the geometrical conditions very often are complicated a calculation is usually impossible. Therefore a purely empirical test has been carried out, as typical types of material in simple circular shapes have been embedded and then exposed to a step-stress test with lower and lower temperature until the temperature of cracking has been reached. Totally 26 different variants of casting materials have been tested and 15–18 different parameter investigations for each material variant have been carried out. Besides this a more systematic work relating to filler materials, flexibilizers, and curing procedure have been carried out. Author (ESRO)

N69-34440# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REDUCING THE FLAMMABILITY OF ELASTIC POLYURETHANE
E. A. Bulygina et al 31 Jan. 1969 9 p refs Transl. into ENGLISH from Plasticheskiye Massy (Moscow), No. 1, 1968 p 30–31
(AD-687235; FTD-HT-23-1061-68) Avail: CFSTI CSCL 11/10

Studied was the influence of additions of antimony trioxide in combination with polyvinyl chloride (PVC) on the flammability and physicomechanical properties of flexible polyurethane foams (FPU) based on complex polyesters. Author (TAB)

N69-34491# Picatinny Arsenal, Dover, N.J. Feltman Research Labs.
PREDICTION OF LIFETIMES OF NYLON SAMPLES AT VARIOUS STRESS LEVELS
Elise McAbee and David W. Levi May 1969 33 p refs
(AD-688586; PA-TR-3871) Avail: CFSTI CSCL 11/9

Several kinetic methods and a superposition procedure were applied to static mechanical property data for glass-filled nylons. The correlations were reasonably satisfactory. It is shown how lifetimes of the materials may be calculated. Author (TAB)

N69-34496# Martin Co., Baltimore, Md. Research Inst. for Advanced Studies.
EFFECT OF ELECTRONIC STRUCTURE ON THE MECHANICAL BEHAVIOR OF THE TRANSITION METAL CARBIDES AND THEIR ALLOYS Final Report, 28 Apr. 1966 – 27 Apr. 1969
Graham E. Hollox Apr. 1969 12 p refs
(Contract DA-31-124-ARO(D)-467)
(AD-688674; RIAS-TR-69-6C; AROD-6388-7-MC) Avail: CFSTI CSCL 11/2

The program was concerned with the mechanical behavior of TiC, VC and TiC-VC alloys, the object being to correlate the mechanical behavior of these materials with their electronic structure. The major problem restricting the utilization of the carbides in practical applications is their extreme brittleness, which is thought to be a direct consequence of the rigid and directional bonding i.e. a high Peierls stress in the lattice. The original object of the program was to characterize the mechanical behavior of TiC-VC alloys and to associate this with changes in the occupancy of electron states and hence the Peierls stress in these alloys. TAB

N69-34510# Rocky Flats Div. Dow Chemical Co., Golden, Colo.
CONTINUOUS VIEWING WINDOW
R. Donald Bowdey, William R. Dahl, and Richard L. Beno 11 Apr. 1969 5 p refs
(Contract AT(29-1)-1106)
(RFP-1141) Avail: CFSTI

Newly developed devices for use in the operation of vacuum deposition chambers or welding chambers are described. To achieve better operator visibility and to simplify cleaning of view ports, a

device was developed which holds a film strip in place by means of spools. The film strip made of Mylar polyester can be easily wound from one spool to another across the chamber window opening permitting operators to manipulate the strip to obtain a clean and clear view whenever necessary during operations. As an accessory to the device, a heat-shield shutter was designed for use with high temperatures or high-rate coatings. The devices can be used for various coating system processes. Author (NSA)

N69-34547*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF CYCLIC HEATING AND THERMAL SHOCK ON HAFNIA STABILIZED WITH CALCIA, MAGNESIA, and YTTRIA
John D. Buckley and David R. Wilder (Iowa State Univ., Ames)
Washington Aug. 1969 43 p refs
(NASA-TN-D-5279) Avail: CFSTI CSCL 1/C

Solid solutions of HfO_2-CaO, HfO_2-Y_2O_3, and HfO_2-MgO were studied for: (1) temperature effects on stabilization (the process of eliminating or limiting the monoclinictetragonal crystallographic inversion common in hafnia at ≈1700°C); (2) effects of cyclic heating on the crystal lattice stability; and (3) thermal shock effects on partially and fully stabilized hafnia. Calcia-stabilized hafnia exhibited similar solubility when sintered at 2000° and at 1800°C. Yttria-stabilized hafnia indicated that sintering at 2000°C and at times over 9 were necessary to obtain near-maximum solution. The high vapor pressure of magnesia limits sintering temperatures for magnesia-stabilized specimens to 1800°C. Yttria-stabilized hafnia maintains its stability whereas magnesia- and calcia-stabilized specimens destabilize when subjected to a single heat cycle (25° to 1750°C). Reheating to 1925° C for 30 min under 10^{-5} torr did not produce restabilization. Hafnia stabilized with calcia or yttria maintained original stability when subjected to 25 cycles between 1040° and 1730°C in air at ambient pressure. Magnesia-stabilized hafnia was stable when removed from the furnace at 1730°C and cooled in ambient air, but was unstable when removed at 1040°C and cooled under the same conditions. Overall thermal-shock resistance yttria-stabilized hafnia quickly cooled in ambient air from temperatures up to 2000°C was superior to the others. K.W.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-33203# Wisconsin Univ., Madison. Mathematics Research Center.
BILINEAR ORTHOGONAL EXPANSIONS OF POSITIVE FUNCTIONS
Richard Askey Jun. 1968 15 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-687310; MRC-TSR-888) Avail: CFSTI CSCL 12/1

Two theorems are obtained for positive bilinear expansions in terms of classical orthogonal polynomials. Author (TAB)

N69-33214# Wisconsin Univ., Madison. Mathematics Research Center.
A GENERALIZATION OF AN INEQUALITY OF VAN DANTZEIG
B. Harris Sep. 1968 9 p ref
(Contract DA-31-124-ARO(D)-462)
(AD-687309; MRC-TSR-840) Avail: CFSTI CSCL 12/1

The inequality the integral from 0 to 1 of (f squared (x))dx = or < 1/12 was stated by van Dantzig for all functions of a certain class. This inequality is generalized. Author (TAB)

N69-33235# Imperial Chemical Industries, Ltd., London (England).
THE USE OF DAVIDON'S METHOD IN NONLINEAR PROGRAMMING
D. Davies Aug. 1968 36 p refs
(MSDH/68/110) Avail: CFSTI

Davidon's method is generally recognised to be the most powerful method of unconstrained optimization. A review is given of previous work in applying it to constrained problems and a new method for handling non linear inequality constraints is presented. This latter method could be applied to any gradient method of optimization and results with Davidon's method are very encouraging. Author

N69-33330*# Massachusetts Inst. of Tech., Cambridge.
DIGITAL COMPUTER ANALYSIS OF LINEAR SHIFT-VARIANT SYSTEMS
Thomas S. Huang *In* NASA Evaluation of Motion-Degraded Images 1969 p 83-87 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 12A

We discuss here the problem of how often we should sample in analyzing linear shift-variant systems on a digital computer, and also the problem of whether it would be faster to perform the analysis via the frequency domain rather than directly in the spatial domain. Fourier analysis provides partial answers to the first problem. In particular, it can be used to find sufficient sampling rates. The analysis can be done faster, however, directly in the spatial domain rather than via the frequency domain. Author

N69-33368*# Israel Program for Scientific Translations, Ltd., Jerusalem.
FUNCTIONAL NUMERICAL METHODS FOR ESTABLISHING OPTIMUM SOLUTIONS
In its Mech. of Spaceflight Low-Thrust 1969 p 434-462 (See N69-33354 19-28)
Avail: CFSTI CSCL 12A

Formulations of Mayer's classic variational problem, the Lagrange problem, and boundary-value problems of ordinary differential equations are presented. Numerical methods of solving the variational problems are classified into direct and indirect ones. Those belonging to the first class are based on various iterative processes of successively decreasing (or increasing) the functional; indirect methods start by reducing the variational problem to a boundary-value problem. A functional analysis method of solving the above formulated problems is described. The general ideas are illustrated by examples from spaceflight mechanics. K.R.G.

N69-33369*# Israel Program for Scientific Translations, Ltd., Jerusalem.
FINITE-DIMENSIONAL NUMERICAL METHODS OF ESTABLISHING OPTIMUM SOLUTIONS
In its Mech. of Spaceflight Low-Thrust 1969 p 463-475 (See N69-33354 19-28)
Avail: CFSTI CSCL 12A

Two approaches are available to reduce the variational problems into a suitable form so that these methods may be applied. The first replaces the functionals by functions of a finite number of variables, e.g., the Ritz method, the method of polygonal lines, etc.; the second consists in finding the finite number of missing initial conditions. Two sections are presented; in the first the most common finite-dimensional methods are described, and in the second, methods of reducing the variational problems to the required form are outlined. K.R.G.

N69-33370*# Israel Program for Scientific Translations, Ltd., Jerusalem.
DESCRIPTION OF THE DYNAMIC MANEUVERS
In its Mech. of Spaceflight Low-Thrust 1969 p 476–496 (See N69-33354 19-28)
Avail: CFSTI CSCL 12A

Summarized is the system of differential equations and their boundary conditions, which describes the following basic dynamic maneuvers characterizing low-thrust engines: interplanetary flight, holding the satellite within a specified spherical layer, and rotating the orbital plane of a satellite. The corresponding elementary models of the maneuvers are also given. The maneuvers are described in a section which gives various forms of the equations of motion and transformations between different types of variables.
K.R.G.

N69-33429*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW ITERATION FOR LOCATING EQUILIBRIUM POINTS IN NONLINEAR SYSTEMS
Clarence Cantor and Fawzi P. Emad (Md. Univ., College Park) Jul. 1969 26 p refs
(NASA-TM-X-63822; X-732-69-306) Avail: CFSTI CSCL 12A

A discrete nth order nonlinear dynamic system, or an iteration for a nonlinear set of n algebraic equations in n unknowns, can be represented by $x_{k+1} = f(x_k)$ where x_k is an nth order state vector. The problem is to locate the equilibrium points of the system, give some approximation of these points, when the original iteration is divergent or only slowly convergent. Newton's method solves the problem in general, but requires f(x) to be available in analytic form and also requires extensive computation of partial derivatives. Steffensen's iteration, utilizing sets of n + 2 iterates obtained from the original iteration, can also solve the problem while avoiding the difficulties in Newton's method. However, the proposed method should produce better results in near singular cases where Steffensen's iteration can cause discrepancies due to numerical errors.
Author

N69-33477# Nuklearni Institut Josef Stefan, Ljubljana (Yugoslavia).
THE PARTICLE-HOLE MATRIX: ITS CONNECTION WITH SYMMETRIES AND COLLECTIVE FEATURES OF THE GROUND STATE
M. Rosina and C. Garrod (Calif. Univ., Davis) Nov. 1968 14 p refs Submitted for publication Supported in part by USAEC
(NIJS-R-552) Avail: CFSTI

A detailed study is made of the properties of the particle-hole matrix. It is shown that the zero eigenvalues of the matrix are intimately and simply related to the one-body symmetries of the ground state. It is also shown that the large eigenvalues are closely related to the collective features of the ground state.
Author

N69-33485# Technische Hochschule Munchen (West Germany).
CONTRIBUTION TO THE PLANE ELASTICITY THEORY WITH SPECIAL CONSIDERATION OF SINGULAR FORCE INTRODUCTIONS [BEITRAG ZUR EBENEN ELASTIZITAETSTHEORIE UNTER BESONDERER BERUECKSICHTIGUNG SINGULAERER KRAFTEINLEITUNGEN]
Heinz Mertens (Ph.D. Thesis) 1969 120 p refs In GERMAN
Avail: CFSTI

The stress and displacement conditions in open circular rings and infinitely extending wedges are solved by means of the Fourier transformation. The applicable transfer matrices are derived. Treated as special cases are the matrices for disc strips and closed circular rings. The theory of generalized functions is used to investigate problems in connection with the introduction of singular forces, i.e. load distributions which are beyond representation by constant functions.
Transl. by K.W.

N69-33522*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
THE POTENTIAL CALCULATION
R. W. Hockney (NRC-NAS) *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 7 p refs (See N69-33499 19-25)
Avail: CFSTI CSCL 12A

Methods are described for calculating the potential on a uniform rectangular mesh due to a distribution of charge on the same mesh. Revised operation counts are given for a direct method of solving the 2D Poisson equation which solves the difference equations exactly in the time of 5 or 6 S.O.R. iterations. The rate of error decay for different iterative methods was studied and the cyclic Chebysher method is found to have the best performance. A Fourier Transform technique is described for solving the case when the force of interaction between charges is arbitrary and this is applied to an isolated system of point charges moving in a plane. All the results are supported by timing working programs on the CDC 6600. The cycle time on a (256 × 256) mesh in space, with 50,000 particles is 4.5 secs for a 2D rod model and 10.4 secs for an isolated system with arbitrary forces.
Author

N69-33525# Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.
ASPECTS OF AN EXPERIMENT FOR THE COLLABORATION OF MATHEMATICS AND APPLIED RESEARCH ACTIVITY [ASPETTI DI UN'ESPERIENZADI COLLABORAZIONE MATEMATICA AD ATTIVITA' DI RICERCA APPLICATA]
A. Ascari 1968 26 p In ITALIAN Presented at Math. Seminar for the Super. Normal School, Pisa, 28 Feb. 1968
(SORIN-143; M/330) Avail: CFSTI

An experiment in mathematics applied to research in physics, chemistry, and engineering is discussed in the light of the development of productive activities. A specific example is described in the hope that it will interest and help a young researcher. The example analyzed is of the collaboration of mathematics applied to experimental research in determining the coefficients of diffusion in metals.
Transl. by F.O.S.

N69-33563# Research Analysis Corp., McLean, Va.
BAYESIAN ANALYSIS OF THE WEIBULL PROCESS WITH UNKNOWN SCALE AND SHAPE PARAMETERS
Richard M. Soland Apr. 1969 20 p refs
(Contract DAHC19-69-C-0017)
(AD-687289; RAC-TP-359) Avail: CFSTI CSCL 14/4

The author previously examined the Weibull process with unknown scale parameter as a model for Bayesian decision making. Here the analysis is extended by treating both the shape and scale parameters as unknown. It is not possible to find a family of continuous joint prior distributions on the two parameters that is closed under sampling, hence a family of prior distributions is used that places continuous distributions on the scale parameter and discrete distributions on the shape parameter. Prior and posterior analyses are examined and seen to be no more difficult than for the case in which only the scale parameter is treated as unknown, but preposterior analysis and determination of optimal sampling plans are considerably more complicated in this case. Two examples are presented to illustrate the use of the present model. In the first of these it is necessary to make probability statements about the

mean life and reliability of a long-life component both before and after life testing. The second example involves determination of the probability distribution of the number of replacement items needed by a group of users during a specified time interval. Author (TAB)

N69-33609*# Decision Science, Inc., San Diego, Calif.
TWO NEW METHODS FOR OBTAINING STABILITY DERIVATIVES FROM FLIGHT TEST DATA
George H. Burgin Sep. 1968 59 p refs Revised
(Contract NAS4-1280)
(NASA-CR-96005-Rev) Avail: CFSTI CSCL 12A

Two new methods for obtaining control and stability derivatives from observed flight data are developed. The first method is based on a quasilinearization procedure and is applicable in parameter identification problems where the plant is modeled by a system of linear differential equations, and noisy measurements of state and control variables are available. Computationally, this method is equivalent to a modification of the Newton–Raphson method. The second, a directed random search method is based on a concept called evolutionary programming, and is also applicable for nonlinear problems. Using X-15 flight test data, the two methods are compared and stability and control derivatives for the lateral motion of the X-15 are given. Author

N69-33612# Eidgenossisches Technische Hochschule, Zurich (Switzerland).
INDEX, DIVERGENCE, AND STABILITY IN AUTONOMOUS SYSTEMS [INDEX, DIVERGENZ UND STABILITAET IN AUTONOMEN SYSTEMEN]
Hans Jakob Brauchli (Ph.D. Thesis) 1968 83 p refs In GERMAN *Its* Diss. Nr. 4041
Avail: CFSTI

A system of n ordinary independent differential equations can be described as vector field in R^n. This corresponds to a field of unitary vectors or a directional field. Classification of two dimensional fields shows that all stable phases have the index +1. The analog formulated index criterium for arbitrary n represents the necessary condition for asymptotic stability and can be amended by a divergence criterium that the asymptotic stable phase cannot serve as source for the vector field. These two criteria are used to formulate stability conditions for a two dimensional field contained in a permanently rotating unsymmetric force-free top. Transl. by G.G.

N69-33619# Technische Hochschule Munchen (West Germany).
MICROSCOPIC DERIVATION OF LINEARIZED KINETIC EQUATIONS [MIKROSKOPISCHE ABLEITUNG LINEARISIERTER KINETISCHER GLEICHUNGEN]
Peter Woelfle (Ph.D. Thesis) 1969 84 p refs In GERMAN
Avail: CFSTI

Kinetic equations are used to analyze nonequilibrium properties of the following three systems: (1) a normal system of strongly interacting neutral fermions at low temperatures; (2) a weak system of strongly interacting neutral particles; and (3) a normal system of charged fermions in degenerating and nondegenerating states. The formalism of the Green function is used to obtain the kinetic equations and to establish the Landau expression for the density and flow operators contained in the microscopic theory. A system of two coupled integral equations is applied to obtain two distribution functions and their solutions for the structural function in neutron scattering or light scattering on real gases of arbitrary energy and impulse transfers and to form a linearized Boltzmann equation for the second virial coefficients of the transport values. Finally, a systematic theory for plasma oscillations is developed for the case of a degenerating electron gas. Transl. by G.G.

N69-33680# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France). Faculte des Sciences.
ON SOME RECENT WORK OF DOBRUSHIN
J. Ginibre [1969] 18 p refs Presented at the Colloq. Intern. of CNRS, May 1969
Avail: CFSTI

Recent work on the statistical mechanics of infinite classical lattice systems, especially some new results on existence of phase transitions in Ising models with repulsive interactions, is presented. The configuration of the system is a subset or equivalently a function. The system is described as a stochastic process with discrete parameters and values. Inverse temperature and the Hamiltonian are defined by chemical potential and interaction potential. Emphasis is restricted to two-body interactions given by a translation of invariant potential. J.M.C.

N69-33692# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
MOMENTS OF MOMENTS AND FREQUENCIES. EXPECTATION OF POWER-SUMS RELATED TO CATEGORIZED DATA
K. O. Bowman and L. R. Shenton 21 Apr. 1969 39 p refs
(Contract W-7405-eng-26)
(CTC-13) Avail: CFSTI

Let the population being sampled be classified into a finite or denumerable set of classes, the probability of an occurrence in the i^{th} class being p_i, and n_i being the observed frequency in this class out of a sample of n. The problem considered is the expectation of any ϕ -product such as $\phi^{\alpha}_{i} \phi^{\beta}_{j} \ldots \phi^{\omega}_{r}$, where ϕ_s is a quantic of weight s in the random increments $\epsilon_i = n_i/n - p_i$. If the total weight of the product $\phi^{\alpha}_{i} \phi^{\beta}_{j} \ldots$ is not too high, an operational procedure is given which derives the required expectation by a polarization process applied to a power of ϕ_1. Author (NSA)

N69-33693# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
ON RESTRICTED NON-LINEAR DIRICHLET PROBLEMS
Dale W. Lick 9 Apr. 1969 17 p refs
(Contract W-7405-eng-26)
(CTC-11) Avail: CFSTI

The Dirichlet problem was considered for the equation $\Delta u = f(P,u)$, where Δ is the Laplacian operator, $P = (x_1 \ldots x_n)$ and f is non-linear. Most results for this kind of problem require certain smoothness conditions on f for all u. However, in many applied problems, such as those arising in non-linear diffusion or heat generation studies, the physical significance of u or the form of f may limit the set of acceptable values for u. The purpose of this paper was to investigate such restricted problems. Author (NSA)

N69-33701# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE FUNCTIONAL RELATIONS BETWEEN THE MATRIX ELEMENTS OF THE ELASTIC SCATTERING STATIC S-MATRIX
V. A. Meshcheryakov and K. V. Rerikh 1969 11 p refs In RUSSIAN
(JINR-P2-4386) Avail: AEC Depository Libraries

An algorithm for finding the polynomial functional relations between the matrix elements of the s matrix in equations of the Chew–Low type is suggested. The algorithm is suitable in searching for the functional relations using a computer and is applied to finding the functional relations in equations with the 3×3 matrix A. Author (NSA)

N69-33737# Norwegian Computing Center, Oslo (Norway).
A SHORT SURVEY OF INTEGER PROGRAMMING
Douglas V. Smith [1968] 32 p refs
Avail: CFSTI

Programming methods in connection with mathematical problems involving variables restricted to discrete values and problems that can be linearized by restricting some variables to discrete values are reviewed. Covered are: (1) discrete variable problems; (2) combinatorials having unimodal constraint matrices; (3) industrial scheduling; (4) problems with mutually exclusive sets of constraints; (5) ill-behaved combinatorial problems (traveling salesman problem); (6) the knapsack problem; (7) capital budgeting in the firm; (8) code constructions; and (9) warehouse location problems. A discussion of algorithms for solving integer programs covers cutting plane methods, primal methods, partial enumeration methods, Boolean algebra methods, and such other methods of special interest as partitioning, rounding, dynamic programming, integer quadratic programming, generalized Lagrange multipliers, sequential random sampling, and discrete optimizing. K.W.

N69-33751# Pennsylvania State Univ., University Park. Ordnance Research Lab.
THE SPECTRA OF NONSTATIONARY RANDOM PROCESSES
C. A. Mason Jan. 1969 82 p refs
(Contract NOw-65-0123)
(AD-687687; TM-649.2341-02) Avail: CFSTI CSCL 9/4

The use of spectral techniques for the computation of the expected power output of linear time invariant filters subjected to a nonstationary noise is studied. The two-dimensional power spectrum is defined, and its use for computing the time varying expected power output is illustrated. The derivation of the one-dimensional energy spectrum from the two-dimensional power spectrum is shown. The derivation of the instantaneous power spectrum as the derivative of the truncated energy spectrum is shown. It is concluded that the instantaneous power spectrum is not a useful engineering technique since there are no expressions relating the instantaneous power spectrum at the filter output to that at the input. For the special case in which the nonstationary noise is the product of a modulation function and a stationary noise, it is shown that the problem can often be reduced to an equivalent stationary problem and solved in a well known way. Author (TAB)

N69-33772# Stanford Univ., Calif. Dept. of Computer Science.
HANDBOOK SERIES LINEAR ALGEBRA: SINGULAR VALUE DECOMPOSITION AND LEAST SQUARES SOLUTIONS
G. H. Golub and C. Reinsch May 1969 42 p refs
(Contract N00014-67-A-0112)
(AD-687716; SU-CS-133) Avail: CFSTI CSCL 12/1

Two Algol procedures are given which are useful in linear least squares problems. The first procedure computes the singular value decomposition by first reducing the rectangular matrix A to a bidiagonal matrix, and then computing the singular values of the bidiagonal matrix by a variant of the QR algorithm. The second procedure yields the components for the linear least squares solution when it is desirable to determine a vector X tilde for which norm (Ax-b) sub 2 = min. Author (TAB)

N69-33823# Wisconsin Univ., Madison. Mathematics Research Center.
OPTIMAL APPROXIMATION AND CHARACTERIZATION OF THE ERROR AND STABILITY FUNCTIONS IN BANACH SPACES Summary Report
Jean Pierre Aubin Sep. 1968 26 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-687455; MRC-TSR-935) Avail: CFSTI CSCL 12/1

Besides the best approximation projector, the author introduces the stabilization onto a subspace P which maximizes the cosine of the angle between u and an element v of P. The error and stability functions are characterized as eigenvalues of nonlinear operators involving those two projectors. Author (TAB)

N69-33829# Stanford Univ., Calif. Dept. of Computer Science.
MATRIX DECOMPOSITIONS AND STATISTICAL CALCULATIONS
Gene H. Golub Mar. 1969 54 p refs Sponsored in part by NSF
(Contract N00014-67-A-0112)
(AD-687719; CS-124) Avail: CFSTI CSCL 12/1

Several matrix decompositions which are of some interest in statistical calculations are presented. An accurate method for calculating the canonical correlation is given. Author (TAB)

N69-33831# Stanford Univ., Calif. Dept. of Computer Science.
THE METHOD OF ODD/EVEN REDUCTION AND FACTORIZATION WITH APPLICATION OF POISSON'S EQUATION
B. L. Buzbee, G. H. Golub, and C. W. Nielson Apr. 1969 43 p refs Prepared in cooperation with Los Alamos Sci. Lab.
(Contract N00014-67-A-0112)
(AD-687717; CS-128) Avail: CFSTI CSCL 12/1

Several algorithms are presented for solving block tridiagonal systems of linear algebraic equations when the matrices on the diagonal are equal to each other and the matrices on the subdiagonals are all equal to each other. It is shown that these matrices arise from the finite difference approximation to certain elliptic partial differential equations on rectangular regions. Generalizations are derived for higher order equations and non-rectangular regions. Author (TAB)

N69-33855# Wisconsin Univ., Madison. Mathematics Research Center.
AN ECONOMIC INTERPRETATION OF DUALITY IN LINEAR PROGRAMMING Technical Summary Report
Elmor L. Peterson Dec. 1968 48 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-687458; MRC-TSR-953) Avail: CFSTI CSCL 12/1

The paper develops new duality relations in linear programming which give new economic interpretations to the dual problem. These duality relations are part of a new closed-form solution to an economically interesting class of linear programming problems. A generalization of these results to geometric programming is announced, and potential extensions to integer programming as well as potential applications to stochastic programming are indicated. Author (TAB)

N69-33856# Wisconsin Univ., Madison. Mathematics Research Center.
A CONVERGENT SPLITTING OF MATRICES Technical Summary Report
O. L. Mangasarian Jan. 1969 10 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GP-6070)
(AD-687461; MRC-TSR-958) Avail: CFSTI CSCL 12/1

Let A, M, N be n x n real matrices, let A = M - N, let A and M be nonsingular, let My = or > 0 imply Ny = or > 0, and let Ay = or > 0 imply Ny = or > (where the prime denotes the transpose). Then the spectral radius rho(M superscript(-1) N) of M superscript (-1) N is less than one, and the iterative process x superscript (i+1) = M superscript (-1) N (x superscript i) + M superscript (-1) b converges to the solution of Ax = b starting from any x superscript zero. Author (TAB)

N69-33881# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (france).
ON THE AXIAL CURRENT WARD-TAKAHASHI IDENTITIES
D. Amati, C. Bouchiat and J. L. Gervais May 1969 25 p refs
(LPTHE-TH-69/27) Avail: CFSTI

Using a gauge invariant regularization technique involving regulator fields quantized with the wrong statistics, a general analysis of the anomalous properties of the axial current divergence in presence of external non abelian gauge vector fields is given. The anomaly in the Ward-Takahashi identities appears as the regulator contribution to the matrix element of the axial current divergence, in the limit of infinite regulator mass. In some instances the limit is finite and independent of the detail of the regularization procedure, but in the other ones the limit is infinite. The break down of the partial converted axial currents (PCAC) relation in presence of vector fields is discussed in the framework of the regularized field theoretical model. It is shown that the physical implications of PCAC would be jeoparzied in a theory with strongly coupled canonical vector fields as the field algebra scheme. Author

N69-33900# Florida State Univ., Tallahassee. Dept. of Statistics.
PARTIALLY BAYES ESTIMATES
Daniel L. Solomon Jan. 1969 90 p refs
(Contract Nonr-988(13))
(AD-685595; FSU-M152) Avail: CFSTI CSCL 12/1

Statistical decision problems are considered in which the decision maker is assumed to have prior information but cannot completely specify a prior distribution. The decision makers prior knowledge is reflected in his willingness to specify a subset, Lambda *(called an incompleteness specification) of the class of all prior distribution lambda. He is then recommended to select the decision rule to minimize the maximum over distributions in Lambda * of the Bayes risk. Such a rule is called partially Bayes with respect to Lambda *, and reduces to the Bayes rule with respect to lambda if Lambda * = (lambda) and the minimax rule if Lambda * = Lambda. The particular problems of estimation of a general mean and a Normal variance are considered in detail. Examples of the determination of optimal sample size and incompleteness specification are given for the two problems. TAB

N69-33922# Norwegian Computing Center, Oslo (Norway).
QUADRATIC ASSIGNMENT PROBLEM
Douglas V. Smith [1968] 37 p refs
Avail: CFSTI

Methods and design programs for the assignment of facilities to locations are discussed. Seven test problems are considered which cover plant layout, assignment of plants to geographically dispersed areas, and placing modules on an electronic device. Various algorithms and integer linear programming for obtaining optimal and suboptimal assignments are examined. Flow diagrams and suggestions for improving the computer programs are presented. K.W.

N69-33941# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
CLASSES OF COMPUTABLE FUNCTIONS DEFINED BY BOUNDS ON COMPUTATION Preliminary Report
E. M. Mc Creight and A. R. Meyer Apr. 1969 30 p refs
(Contract F44620-67-C-0058)
(AD-687494; AFOSR-69-1212TR) Avail: CFSTI CSCL 12/1

The structure of the functions computable in time or space bounded by t is investigated for recursive functions t. The t-computable classes are shown to be closed under increasing recursively enumerable unions; as a corollary the primitive recursive functions are shown to equal the t-computable functions for a certain recursive t. Any countable partial order can be isomorphically embedded in the family of t-computable classes partially ordered by set inclusion. For any recursive t, there is a recursive t which is (approximately) equal to an actual running time such that the t-computable functions equal the t-computable functions. Author (TAB)

N69-33944# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
BERNOULLI SAMPLING PLANS WHICH APPROXIMATELY MINIMIZE THE MAXIMUM EXPECTED SAMPLE SIZE SUBJECT TO CERTAIN PROBABILITY REQUIREMENTS
James E. Higgins Feb. 1969 68 p refs
(Contracts DA-31-124-ARO(D)-474; Nonr-401(53); Grant NSF GP-7798)
(AD-687424; TR-65) Avail: CFSTI CSCL 12/1

The author, in his masters thesis, constructed a catalog of 442 Bernoulli sampling plans which approximately minimize the maximum expected sample size among all plans which guarantee certain O.C. probability requirements. Fifty-two of these plans (which would appear to be of greatest practical interest) are presented in this report. A.S.N. curve comparisons are made with plans based on the Wald sequential probability ratio test and the fixed sample size test which guarantee the same O.C. probability requirements. Author (TAB)

N69-33989# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
DETERMINATION OF THE TIME-DOMAIN EQUIVALENTS OF HIGHER ORDER LAPLACE TRANSFER FUNCTIONS BY ANALOG COMPUTATION
Jesus Leon and Emilio Herraro Nov. 1968 33 p refs
(Contract DAHC04-68-C-0002; Proj. Themis)
(AD-687302; TR-17; T-1:30-RT) Avail: CFSTI CSCL 12/1

In the theory of the optimal inventory control a class of complex Laplace transforms arises where it becomes highly desirable for the theoretist to know the form and shape of their time domain equivalents. Several methods have been used to obtain these time domain equivalents. In this paper an Analog Computer simulation has been used. Furthermore, a low order approximation of higher order transfer functions has been simulated. The accuracy of this low order approximation has been determined by use of time domain plots. Author (TAB)

N69-34010# Douglas Aircraft Co., Inc., Huntington, Beach, Calif. Advanced Research Labs.
ON A GROUP THEORETICAL CONNECTION AMONG THE PHYSICAL HIERARCHIES
A. Sankaranarayanan Apr. 1969 34 p refs *Its* Res. Commun. No. 96
(AD-687539) Avail: CFSTI CSCL 20/10

The question whether one can extend the non-relativistic homogenous galilei group to the relativistic homogeneous lorentz group and then to the cosmological desitter group in an ascending fashion is raised and answered in the affirmative. Author (TAB)

N69-34027# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
SOME OPTIMAL CONTROL RESULTS FOR DIFFERENTIAL DIFFERENCE SYSTEMS Interim Technical Report
A. E. Bryson, Jr. and J. J. Budelis Mar. 1969 27 p refs
(Contract N00014-67-A-0298)
(AD-687473; TR-584) Avail: CFSTI CSCL 12/1

The development of necessary conditions for an extremal path in the case where the system equations and the performance

index contain a time delay in both the state and the control variables is presented. A non-iterative method of solution is presented for a linear system with a quadratic performance index for the case where the control variable appears in the system equations evaluated both at the present time and a previous time. Author (TAB)

N69-34035# Sheffield Univ. (England). Dept. of Probability and Statistics.
A COORDINATE-FREE DESCRIPTION OF CLASSICAL MECHANICS
K. R. Parthasarathy May 1968 16 p ref
(RR-44/KRP6) Avail: CFSTI

A manifold representing a set of possible instantaneous configurations for a classical mechanical system is studied in a coordinate-free form in which a point and a vector in the tangent space are determined. The special properties of a manifold system where states are determined by positional coordinates and velocities are discussed. Author

N69-34049# Wiconsin Univ., Madison. Mathematics Research Center.
TWO TEST CASES FOR THE NUMERICAL SOLUTION OF HARMONIC MIXED BOUNDARY VALVE PROBLEMS
David H. Schultz Aug. 1968 17 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-687454; MRC-TSR-900) Avail: CFSTI CSCL 12/1

Two harmonic mixed boundary value problems are solved exactly. The accuracy of some results obtained by standard finite difference methods is discussed briefly. Author (TAB)

N69-34116# Army Tank-Automotive Center, Warren, Mich.
UTILIZATION OF LATIN SQUARE EXPERIMENTAL DESIGN PLANS IN PARAMETRIC STUDIES OF THEORETICAL PROBLEMS
G. L. Wedekind Dec. 1968 50 p refs
(AD-687362) Avail: CFSTI CSCL 12/1

A technique is proposed for reducing the number of repititious solutions required to carry out a conventional parametric study of a theoretical problem. The technique is applicable to a particular class of problems which involve the numerical solution of differential equations. An applicability criterion is presented, along with a method for predicting the errors which might be expected, if a problem does not satisfy the criterion exactly. The proposed technique is applied to a periodic-flow heat exchanger, which is representative of the type of engineering problems to which the technique appears to afford the greatest potential. Author (TAB)

N69-34144# Stanford Univ., Calif. Dept. of Computer Science.
HEURISTIC ANALYSIS OF NUMERICAL VARIANTS OF THE GRAM-SCHMIDT ORTHONORMALIZATION PROCESS
William C. Mitchell and Doulas L. Mc Craith 24 Feb. 1969 26 p ref
(Contract N00014-67-A-0112-0029)
(AD-687450; SU-CS-122) Avail: CFSTI CSCL 12/1

The Gram-Schmidt orthonormalization process is a fundamental formula of analysis which is notoriously unstable computationally. This report provides a heuristic analysis of the process, which shows why the method is unstable. Formulas are derived which describe the propagation of round-off error through the process. These formulas are supported by numerical experiments. These formulas are then applied to a computational variant of a basic method proposed by John R. Rice, and this method is shown to offer significant improvement over the basic algorithm. This finding is also supported by numerical experiment. The formulas for the error propagation are then used to produce a linear corrector for the basic Gram-Schmidt process, which shows significant improvement over both previous methods, but at the cost of slightly more computations. Author (TAB)

N69-34147# Tokyo Univ. (Japan). Inst. for Solid State Physics.
EIGENVALUES OF ORBITAL ANGULAR MOMENTUM
Masuo Suzuki Dec. 1968 8 p refs
(ISSP-A-342) Avail: AEC Depository Libraries

Orbital angular momentum $L_z = xp_y - yp_x$ is transformed into the difference of the Hamiltonians for two independent one-dimensional harmonic oscillators by a unitary transformation U = exp (−iS), where $S = \pi/4\ (p_x p_y + xy)$ with $\hbar = 1$. This transformation may be useful in discussing, a strong spin-orbit coupling in solid state physics. Consequently, using only the elementary commutation relations $[x,p_x] = [y,p_y] = i$, it is shown that the eigenvalues of L_z are integer. The paper concludes with some remarks on the relation between boundary conditions and eigenvalues in quantum mechanics. Author (NSA)

N69-34192# Delaware Univ. Newark. Dept. of Mathematics.
VERY REGULAR TOURNAMENTS
Russell Remage, Jr. May 1969 32 p refs
(Contract Nonr-4853(00))
(AD-687472; TR-5) Avail: CFSTI CSCL 12/1

In the set of all (round-robin) tournaments of odd order m, the subset of very regular tournaments consist of those which are regular (have constant score sequence) and have circulant representative matrices. These tournaments are characterized and divided into equivalence classes (structures) in which two are equivalent if they represent the same tournament with different designations and orderings of the nodes. Techniques are developed for determination of the automorphism groups (and thus, all subgroups of the symmetric group Sm containing an element of order m) and for minimum number of upsets, and it is shown that maxima in orders of the automorphism groups and in the minimum number of upsets tend to be realized in very regular tournaments. Author (TAB)

N69-34200# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
SOME REMARKS ON CURRENT-FIELD COMMUTATORS
H. Genz and J. Katz Jan. 1969 20 p refs
(DESY-69/2) Avail: AEC Depository Libraries

Implications of the Jacobi identity and Lorentz invariance in the study of equal time current-field and current-current commutators are discussed. It is shown that these commutators are related by means of the Jacobi identity. Assuming Lorentz invariance it is then proven that equal time commutators between space components of conserved currents and spinor fields do not have Schwinger terms, provided the same holds for their time components. Moreover, the commutators between the time derivatives of space components of these currents and the field can only have first order Schwinger terms. These results are also obtained for nonconserved currents whose divergences commute at equal times with the field. In general, equal time commutators between divergences of currents (or their time derivatives) and fields cannot have first (second) order Schwinger terms. Connections with usual quark and field algebra relations are discussed. Author (NSA)

N69-34203# Aberdeen Research and Development Center, Aberdeen Proving Ground, Md.
MONTE CARLO INVESTIGATION OF THE ROBUSTNESS OF DIXON'S CRITERIA FOR TESTING OUTLYING OBSERVATIONS
Jerry Thomas Apr. 1969 59 p refs
(AD-688600; ARDC-TM-4) Avail: CFSTI CSCL 12/1

An investigation of the effect of non-normality on the distribution of Dixons criteria for detecting outlying observations is presented here. Monte Carlo techniques were used to determine the distribution of the Dixon statistics when observations are selected from specific non-normal distributions with varying degrees of abnormality. Two such distributions whose degree of abnormality, as determined by the coefficient of skewness, may be varied by changes in the parameters of the distributions are the beta and gamma distributions. A measure of the lack of robustness, that is the sensitivity to departures from normality, in the Dixon criteria may be determined by comparison of the frequency distributions of the Dixon type statistics computed from sampling the non-normal distributions with those values obtained by Dixon when sampling from the normal distribution. Based on the distributions of the Dixon statistics computed from the non-normal distributions, it has been shown that Dixons criteria is not robust and its wide use may result in incorrect decisions when the underlying distribution is asymmetric or skewed. Author (TAB)

N69-34219# Rome Univ. (Italy). Inst. of Physics.
A RIGOROUS DERIVATION OF PROJECTION FORMULAE FOR O(2, 1)-INVARIANT OFF-SHELL FUNCTIONS
S. Ferrara and G. Mattioli 8 Jan. 1969 15 p refs *Its* Nota Interna 201
Avail: CFSTI

Projection formulas for the generalized Laplace transform for a class of O(2, 1)-invariant off-shell functions, are derived in a rigorous way. This transformation is useful for the physical case of spinless particle scattering described by iterated ladder graphs. Author (ESRO)

N69-34228# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
MODEL OF LOCAL THEORY WITH DISTURBED CAUSALITY
B. V. Medvedev, V. P. Pavlov, and A. D. Sukhanov 1969 8 p refs In RUSSIAN
(ITF-69-3) Avail: AEC Depository Libraries

The model with a quantum vector field is constructed. The model contains a unitary S-matrix. The Lagrangian is local: the fields are locally commutative, but the causality in Bogolyubov's sense is disturbed. Author (NSA)

N69-34232# Hamburg Univ. (West Germany). Inst. fuer Theoretische Physik.
EQUAL-TIME COMMUTATORS AND THE ENERGY-MOMENTUM TENSOR
H. Genz and A. Katz Mar. 1969 21 p refs
(DESY-69/11) Avail: AEC Depository Libraries

Starting from a generalization to spinor fields of the equal-time commutator between the time components of the vector and axial vector currents and the energy density part of the gravitational tensor current-field commutators are investigated. It is shown that if the non-Schwinger part of the equal-time commutator between the time components of conserved currents is the time component of a current, then this current is conserved. Necessary and sufficient conditions are given in order for the non-Schwinger part of the equal-time commutators between the time components of conserved and nonconserved currents or between the time components of nonconserved currents to be the time component of a conserved or nonconserved current. Author (NSA)

N69-34262# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
A BRIEF REVIEW OF KRAICHNAN'S DIRECT-INTERACTION APPROXIMATION
Yih-Ho Pao Apr. 1969 7 p refs
(DI-82-0836) Avail: CFSTI

Kraichnan's direct interaction approximation is outlined together with necessary cautions as to its validity. Author

N69-34265# Ballistic Research Labs., Aberdeen Proving Ground, Md.
HARMONIC POLYHEDRA
John H. Giese and Ceslovas Masaitis Mar. 1969 25 p
(AD-687267; BRL-R-1428) Avail: CFSTI CSCL 12/1

A polyhedron of genus P is harmonic if the number of its faces (vertices) is the harmonic mean of its numbers of its edges and vertices (faces). The determination of all permissible combinations of numbers of vertices, edges, and faces is reduced to solution of Pell's equation. Realizations of all such polyhedra with $P = 1$ are described, as well as for all negative P with large enough numbers of edges. Author (TAB)

N69-34273# Commissariat à l'Energie Atomique, Limeil (France).
CALCULATION OF THE PROPER VALUES $\lambda_{mn}(c)$ OF THE SPHEROIDAL EQUATION [CALCUL DES VALEURS PROPRES $\lambda_{mn}(c)$ DE L'EQUATION SPHEROIDALE]
Jean-Marie Dufour (Ph.D. Thesis--Conservatoire Natl. des Arts et Métiers) May 1969 45 p refs In FRENCH; ENGLISH summary
(CEA-R-3711) Avail: CFSTI

The aim of this report is to find, with fair accuracy, a proper value $\lambda_{mn}(c)$ for the spheroidal differential equation: obtained by the separation of the three variables of the wave equation: $\Delta^2 u + k^2 u = 0$ with rotational prolate or oblate ellipsoidal coordinates. A program calculates $\lambda_{mn}(c)$ for any value of (mnc) in the zones $0 \leq |m| \leq 10$, a whole number; $|m| \leq n \leq 20$, n a whole number; $0 \leq |c| \leq 30$ as previous work has covered a smaller field of values. The function to be solved by an approximation method of the Newton-Raphson type, and the initial value, are chosen so as to converge towards the required solution. Author (ESRO)

N69-34274# Rome Univ. (Italy). Inst. of Physics.
A CONSISTENT APPROACH TO CONTINUOUS MOMENT SUM RULES
E. Ferrari (Istituto Nazl. Fis. Nucl.) and G. Violini (Istituto Nazl. Fis. Nucl) 24 Jan. 1969 13 p refs Sponsored partly by AFOSR *Its* Nota Interna 205
(Contract F61052-67-C0084)
Avail: CFSTI

Continuous moment sum rules are rewritten in a form which is more suitable for their understanding and correct application. The results obtained are particularly significant in the cases where the real parts are not experimentally known. It is also shown that continuous moment sum rules are equivalent to a superposition of integer moment sum rules. Author (ESRO)

N69-34278# Rome Univ. (Italy). Inst. of Physics.
CONSTRAINTS ON REGGE-POLE PARAMETERS FROM A NEW FAMILY OF DISPERSION SUM RULES
M. Lusignoli (Aquila Univ.), M. Restignoli, and G. Violini 22 Mar. 1969 10 p refs Sponsored partly by AFOSR *Its* Nota Interna 204
(Contract F61052-67-C0084)
Avail: CFSTI

Integrating the forward dispersion relations over a finite energy region gives a family of sum rules which provide constraints for the scattering amplitude asymptotic behavior. These sum rules are then applied to pion-nucleon scattering. Author (ESRO)

N69-34280# Washington Univ., Seattle. Computer Science Group.
AN EXPERIENCE-GATHERING PROBLEM-SOLVING SYSTEM
J. Ross Quinlan 16 May 1968 72 p refs
(Grant NSF B7-1438R)
(PB-183045; TR-68-1-03) Avail: CFSTI CSCL 09B

Research was undertaken for purpose of the development general-purpose programs which could solve non-trivial problems couched in the second type of representation. Additional requirements were established: the programs were to be written in commonly-available computer languages (FORTRAN 4 and ALGOL), and were to require no reprogramming for different tasks. In short, they were to be feasible experimental tools. Author (USGRDR)

N69-34360*# Philco-Ford Corp., Palo Alto, Calif.
MANIPULATION ERRORS IN FINITE ELEMENT ANALYSIS OF STRUCTURES
R. J. Melosh and E. L. Palacol Washington NASA Aug. 1969 145 p refs
(Contract NAS5-10369)
(NASA-CR-1385) Avail: CFSTI CSCL 12A

These errors for the displacement and force methods of structural analysis for systems of finite elements in series and in parallel are examined. The principal manipulation error involves distortion of the mantissa of the floating decimal representation of the number. This error depends upon the selection of number base, number of places carried, arithmetic mode, and manipulation mode. These characteristics are fixed by the selection of computer hardware and software. The manipulation error is also influenced by problem scale, structural idealization, the sequencing of joints and elements, selection of coordinate axes, element representations used, choice between the force or displacement method, and the algorithm selected for solving the load-deflection relationships for the structure. Errors are studied in the input–output, generation, and elimination phases of calculation. The input–output phase involves that part of the problem in which the data is introduced into the computer and results are output for analyst interpretation. Input errors are not significant. Author

N69-34394# RAND Corp., Santa Monica, Calif.
INTERSECTION GRAPHS OF FAMILIES OF CONVEX SETS WITH DISTINGUISHED POINTS
William F. Ogden and Fred S. Roberts May 1969 5 p refs
Presented at Calgary Intern. Conf. on Combinatorial Struct. and Their Appl., 2-14 Jun. 1969
(AD-688480; P-4094) Avail: CFSTI CSCL 12/1

The family of convex sets is defined and a collection of all finite graphs is proposed. Classes of indifference graphs are theorized and proven. Convex neighborhoods are plotted on a circle and the desired properties of indifference graphs are proven to be identical to the first class of unit interval graphs. M.H.E.

N69-34422# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
FIELDS, OBSERVABLES, AND GAUGE TRANSFORMATIONS. PART 1
Sergio Doplicher (Aix-Marseilles Univ.), Rudolph Haag, and John E. Roberts (Hamburg Univ.) Feb. 1969 32 p refs Sponsored in part by the Roy. Soc.
(DESY-69/9) Avail: AEC Depository Libraries

Starting from an algebra of fields f and a compact gauge group of the first kind G, the observable algebra a is defined as the gauge invariant part of f. A gauge group of the first kind is shown to be automatically compact if the scattering states are complete and the mass and spin multiplets have finite multiplicity. Under reasonable assumptions about the structure of f it is shown that the inequivalent irreducible representations of a which occur are in one-to-one correspondence with the inequivalent irreducible representations of G and that all of them are 'strongly locally equivalent.' An irreducible representation of a satisfies the duality property only if the sector corresponds to a 1-dimensional representation of G. If G is Abelian the sectors are connected to each other by localized automorphisms. Author (NSA)

N69-34493# Texas Univ., Austin. Computation Center.
BOUNDS AND LOCATION THEOREMS OF THE EIGENVALUES OF MATRICES PARTITIONED INTO BLOCKS Interim Technical Report
Gil Chang Kim (Ph.D. Thesis) May 1969 83 p refs
(Grants DA-ARO(D)-31-124-G1050; NSF GP-8442)
(AD-688658; AROD-3772-44-M; ITR-21) Avail: CFSTI CSCL 12/1

The well-known Gerschgorin circle theorem and the subsequent result that the maximum row sum, which is equal to the maximum norm, of an arbitrary square matrix A is an upper bound of the spectral radius depend on the absolute values of the elements of A. Essentially, these results arise from theorems which establish the nonsingularity of A. For example, it is known that A is nonsingular if A is strictly diagonally dominant and the application of this result to A - zI yields the Gerschgorin circle theorem. To generalize this, A is considered to be a matrix partitioned into blocks, where it is assumed that the diagonal blocks are square and non-singular. Then A is non-singular if the matrix (A) is an M-matrix, which is formed by replacing the diagonal blocks in A by their infimums and the off-diagonal blocks by their norms. In a similar manner, the previous bound of the spectral radius can be generalized. These new results can give significant improvements over the usual Gerschgorin circles in providing bounds for the eigenvalues of A under a suitable choice of norms and partitioning. Restricting the choice of norms to the sum norm, the Euclidean norm, and the maximum norm, it is found that improvements are always possible for a class of matrices arising from the numerical solution of partial differential equations. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics and 30 Space Sciences.

N69-33215# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
PROPERTIES OF TURBULENT ENERGY SPECTRA AND COSPECTRA IN THE ATMOSPHERIC SURFACE LAYER Final Report, Dec. 1963 - Jul. 1968
H. E. Cramer and F. A. Record Fort Monmouth, N.J. ECOM Mar. 1969 110 p refs
(Contract DA-AMC-36-039-64-G1)
(AD-687337; ECOM-64G1-F) Avail: CFSTI CSCL 4/2

The report describes turbulent energy spectra and cospectra, and other properties of turbulence in the atmospheric surface layer, obtained from an analysis of comprehensive field measurements made over a period of several years at the Round Hill Field Station. Representative power spectra of air temperature and the orthogonal components of wind velocity and cospectra of the vertical fluxes of sensible heat and momentum are presented for the frequency band from 0.4 to 0.0015 cycles per second. The dependence of the spectra and cospectra on height above ground thermal stratification, and surface roughness is discussed. Calculations of the scales of turbulence and energy dissipation rates are summarized and the correspondence between the measured properties of turbulence structure and various Similarity Theory predictions is outlined. Author (TAB)

N69-33233*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A COMPARISON BETWEEN OBSERVED WINDS AND CLOUD MOTIONS DERIVED FROM NIMBUS 2 HRIR MEASUREMENTS

William E. Shenk and Earl R. Kreins (AF) Jul. 1969 46 p refs (NASA-TM-X-63619; X-622-69-285) Avail: CFSTI CSCL 04B

Cloud motions over oceanic areas were obtained from HRIR measurements contained within the overlapped region of two adjacent Nimbus II orbits. These 108-minute averaged motions were compared with instantaneous wind vectors interpolated from constant pressure charts. Corrections for uncertainties in the attitude of the satellite were made by superimposing coastlines that were within the fields of view for both orbits. Cloud mass centroids were determined to estimate the position for each cloud. Cloud top altitudes were obtained from the Nimbus II HRIR data and the isotherms on the constant pressure charts. Generally, the direction and speed of the cloud motions were within 20° and 15 knots of the observed wind direction and speed. Author

N69-33239# Woods Hole Oceanographic Institution, Mass.

MEDOC-69: A PRELIMINARY REPORT

Arthur R. Miller Apr. 1969 46 p (Contract N00014-66-C-0241) (AD-686674; WHOI-REF-69-24) Avail: CFSTI CSCL 4/2

A narrative report is given on the achievements of the multiship operation MEDOC-69 whose objective was the combined study of air-sea exchange processes and the formation of deep bottom water in the Western Mediterranean Sea during the winter season. In general the operation covered a period of reconnaissance wherein an area of maximum surface density was located and identified, followed by an intensive survey of the water masses. With the onset of a prolonged mistral storm condition the density was increased to the point where deep overturning took place with marked changes in the deep water and general distributions. As the season moved on the density showed a progressive return to normalcy. Direct current measurement and observations demonstrated the formation of a gyre within the area of maximum density with strong shear about the periphery. Vertical velocities were measurable. Author (TAB)

N69-33440# Army Electronics Command, Fort Monmouth, N.J. Atmospheric Sciences Lab.

OBSERVING THE DYNAMIC CHARACTERISTICS OF THE ATMOSPHERE WITH THE MESO CAVITY SPECULAR INTEGRATING REFRACTOMETER (MCSIR SYSTEM)

Arthur V. Carlson and James J. Lamb Mar. 1969 39 p refs (AD-687264; ECOM-6040) Avail: CFSTI CSCL 4/2

In an experiment conducted at Fort Huachuca, Arizona, the low-level atmospheric turbulence and wind structure were sensed by observing variations in integrated radio refractivity of the atmosphere along a radio transmission path 1239 m in length and approximately 10 m above the ground. Phase lock measurement techniques using a 4 GHz transmitter permitted sensing mean refractivity changes as small as 0.1 N unit. Refractivity variation signatures were established for a variety of atmospheric stabilities and wind speeds ranging from absolute calm to thunderstorm conditions. The signatures are reliably repeatable, and very slight changes in atmospheric conditions produce distinctively different refractivity characteristics. Research and operational applications are suggested. Author (TAB)

N69-33457*# Techtran Corp., Glen Burnie, Md.

INSTRUMENT EQUIPMENT OF DRIFTING BUOYS FOR TRANSMISSION OF METEOROLOGICAL AND OCEANOGRAPHICAL DATA VIA SATELLITES. A Preliminary Study

Magne Eggestad [1969] 21 p ref Transl. into ENGLISH of Norweg. Defense Res. Estab. Tek. Notat E-188 (Contract NAS5-14826) (NASA-CR-101132) Avail: CFSTI CSCL 04B

This preliminary study has undertaken a calculation of the necessary radiated effect from the buoy based upon synchronous satellites. The way of handling the system is discussed. Possible technical solutions for equipping buoys with instruments are attached in the form of block diagrams. Author

N69-33566# Naval Postgraduate School, Monterey, Calif.

APPLICATION OF THE NAVY'S NUMERICAL HURRICANE AND TYPHOON FORECAST SCHEME TO 1967 ATLANTIC TROPICAL STORM DATA

Robert J. Renard 15 Mar. 1969 33 p refs (AD-685226; NPS-51RD9031A) Avail: CFSTI CSCL 4/2

Renard recently reported on a numerical scheme for predicting the motion of tropical storms for intervals up to 72 hours. The forecast technique is applied in two steps. First, numerical geostrophic steering of the cyclone center is accomplished using fleet numerical weather central's analyses and prognoses of smoothed isobaric height fields, called SR fields. Next, a statistical correction for vector bias in the numerical steering computation is used selectively in an attempt to improve the accuracy of the forecast track. The bias modification is dependent solely on the peculiarities of recent-history 12- and 24-hour forecasts in relation to the actual storm trajectory. Forecasts for intervals up to 72 hours, generated from the 1967 Atlantic operational storm positions, are compared to the results from previous experimental forecasts for 1966 using besttrack positions of Atlantic storms. Results indicate the numerical scheme shows skill in relation to both 1965 and 1967 official-forecast accuracy as documented by fleet weather facility, Jacksonville, Florida. In 1967, the relative improvement over official forecasts, using 700 MB prognostic SR fields for steering, ranges from 62% at forecast intervals of 7-18 hours to 9% at forecast intervals of 43-54 hours. Discussions of various forecast modes and selective modification schemes as well as stratification of error statistics by area, track, and storm stage are included. Author (TAB)

N69-33578*# Wisconsin Univ., Madison. Dept. of Meteorology.

METEOROLOGICAL SATELLITE INSTRUMENTATION AND DATA PROCESSING Final Scientific Report, 1966 – 1968

Verner E. Suomi and Robert J. Parent Dec. 1968 192 p refs (Contract NASw-65) (NASA-CR-103678) Avail: CFSTI CSCL 04B

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2. INVESTIGATION OF CLOUDS ABOVE SNOW SURFACES UTILIZING RADIATION MEASUREMENTS OBTAINED FROM THE NIMBUS 2 SATELLITE F. F. Hauth (Weather Squadron (5th), Detachment 7, San Francisco) and J. A. Weinman p 16–30 refs (See N69-33576 19-20)

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4. THE REFLECTION OF SUNLIGHT TO SPACE AND ABSORPTION BY THE EARTH AND ATMOSPHERE OVER THE UNITED STATES DURING SPRING, 1962 K. J. Hanson, T. H. Vonder Haar, and V. E. Suomi p 108–124 refs (See N69-33580 19-13)

5. RADIATION ANALYSIS OF A SUBTROPICAL HIGH J. O. Siebers p 125–150 refs (See N69-33581 19-20)

6. ON THE INTERPRETATION OF LONG-WAVE RADIATION DATA FROM EXPLORER 7 SATELLITE F. B. House p 151–164 (See N69-33582 19–20)

N69-33578*# Wisconsin Univ., Madison. Dept. of Meteorology.
INVESTIGATION OF CLOUDS ABOVE SNOW SURFACES UTILIZING RADIATION MEASUREMENTS OBTAINED FROM THE NIMBUS 2 SATELLITE
F. F. Hauth (Weather Squadron (5th), Detachment 7, San Francisco) and J. A. Weinman *In its* Meteorol. Satellite Instrumentation and Data Process. Dec. 1968 p 16–30 refs (See N69-33576 19-20)
(Contract NASw-65; Grant NSF GA-1020)
Avail: CFSTI CSCL 04B

Bidirectional reflectance of solar radiation vs. scattering angles from snow and cloud surfaces were found markedly different. The variation of bidirectional reflectance with scattering angle depends on cloud thickness. Infrared temperature data obtained from the same region was used in conjunction with these observations to provide information on characteristics of clouds located above snow surfaces. Nimbus 2 medium resolution data from consecutive orbits over Greenland on 19 June 1966 are used to illustrate how such data provides information on clouds above snow surfaces.
Author

N69-33581*# Wisconsin Univ., Madison. Dept. of Meteorology.
RADIATION ANALYSIS OF A SUBTROPICAL HIGH
J. O. Siebers *In its* Meteorol. Satellite Instrumentation and Data Process. Dec. 1968 p 125–150 refs (See N69-33576 19-20)
Avail: CFSTI CSCL 04B

Long-wave radiation loss maps, based on Tiros 4 radiometric measurements of terrestrial radiation were analyzed for the Northern Pacific Ocean during the period 20 March to 1 April 1962. These daily radiation analyses were compared to standard synoptic charts. This comparison showed the association of the maximum ridge of radiation to the subtropical high-pressure belt, and the minimum trough of radiation to the intertropical convergence zone. A model of the subtropical high pressure cell was constructed with respect to the long-wave radiation maximum. Synoptic time sequences for island stations in the vicinity of the ridge of maximum radiation were analyzed and compared to the daily fluctuations of terrestrial radiation.
Author

N69-33582*# Wisconsin Univ., Madison. Dept. of Meteorology.
ON THE INTERPRETATION OF LONG-WAVE RADIATION DATA FROM EXPLORER 7 SATELLITE
F. B. House *In its* Meteorol. Satellite Instrumentation and Data Process. Dec. 1968 p 151-164 (See N69-33576 19-20)
Avail: CFSTI CSCL 04B

The geometry connected with interpreting the long-wave radiation detected by the white hemisphere component of the thermal radiation budget experiment aboard Explorer 7, is examined. Such characteristics of Explorer 7 as the size of the area viewed for given satellite heights and the relative contribution of the radiation detected from different parts of the area are of interest before relating radiation values to meteorological parameters. The white hemisphere mounted on its mirror has the same properties as an isolated sphere in space, absorbing radiation from the area viewed on earth and reradiating it over its entire surface. The equilibrium temperature of the sphere depends on the strength of the radiation currents from the earth. Calculations were made for two satellite heights, 550 km and 1100 km, which correspond to the height of perigee and apogee respectively above the earth's equatorial radius.
K.R.G.

N69-33592# Danish Meteorological Inst., Charlottenlund.
PRELIMINARY REVIEW OF THE CLIMATE ON FAROE, BASED CHIEFLY ON OBSERVATIONS DURING NORMAL PERIODS 1931-60 AND ON PARTIAL OBSERVATIONS OF SHORT AIR MEASUREMENTS [FORELOEBIG OVERSIGT OVER KLIMAET PA FAEOEERNE HOVEDSAGELIG BASERET PA OBSERVATIONER I NORMALPERIODEN 1931-60 OG PA EN DEL OBSERVATIONER FRA ET KORTERE AREMAL]
Leo Lysgaard 1969 33 p In DANISH
(Rept-20) Avail: CFSTI

Tables with monthly average values and extremes are presented based on measurements during this period at various locations in the islands. The data include barometric pressure, wind direction and velocity, sunshine, atmospheric temperature, frost and ice formations, humidity, precipitation, isobaric measurements, and tropopause measurements of pressure and temperature. A brief discussion of the Faroe weather and climate and of the methods used to obtain the data is included.
Transl. by K.W.

N69-33593# Danish Meteorological Inst., Charlottenlund
PRELIMINARY REVIEW OF THE CLIMATE OF GREENLAND DURING THE PERIODS 1921-50, 1951-60, AND 1961-65 [FORELOEBIG OVERSIGT OVER GROENLANDS KLIMA I PERIODERNE 1921-50, 1951-60 OG 1961–65]
Leo Lysgaard 1969 39 p In DANISH
(Rept-21) Avail: CFSTI

Brief discussions and tabulated data are presented. The tables reflect monthly climatological averages and extremes as obtained from measurements at several stations in Greenland during these periods. The measurements included barometric pressure; wind direction, velocity, and frequency; atmospheric temperature; number of days with frost and ice formation; precipitation; and aerological data from three of the reporting stations.
Transl. by K.W.

N69-33686# Environmental Science Services Administration, Boulder, Colo. Research Labs.
RADIOMETRIC OBSERVATIONS OF THUNDERSTORM CELLS
Martin T. Decker and Evan J. Dutton *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 617–629 refs (See N69-33626 19-14)
Avail: CFSTI

The thermal noise emission from Colorado thunderstorms was measured using a 10.7 GHz radiometer and an 18-meter diameter steerable parabolic antenna. These measurements were used to prepare contours of integrated liquid water content along radio rays passing through the storm. The experimental data consists of horizontal radiometric scans across the thunderstorm which permit measurements of the difference in antenna temperature when pointing at the clear atmosphere and the storm. Subtracting

the absorption due to the clear sky from that occurring when looking at the storm resulted in an estimate of the absorption due to the storm itself. Since the storm absorption is proportional to the liquid water content with a known constant of proportionality dependent upon the temperature, it is possible to estimate water content of the storm along a line-of-sight. Author

N69-33867# Allied Research Associates, Inc., Concord, Mass.
CIRRUS CLOUD INFLUENCE ON 6.4-6.9 MU OBSERVATIONS
Earl S. Merritt, David Chang, and Donald Beran *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 631-654 refs (See N69-33626 19-14)
(Contract NAS5-10334)
Avail: CFSTI

Empirical analyses of the Nimbus 2 6.4-6.9μ H_2O observations indicate that equivalent blackbody temperatures (T_{bb}) less than 235°K are generally associated with multilayered cloud areas, while T_{bb} values of approximately 240°K and above are found over clear areas, or in areas with cloud tops below 3 km. A large number of areas were found to have T_{bb} values between 235°K and 240°K. These findings are in agreement with computed results using model atmospheres in which all clouds were assumed to be blackbodies radiating at the cloud top temperature. However, tenuous cirrus clouds are not adequately approximated as blackbodies. Tenuous cirrus cloud, visible from the ground (and in Gemini photographs) is observed by the 6.4-6.9μ H_2O channel, but it is not obvious in concurrent "window" radiometric or television pictures. Computations of the 6.4-6.9μ T_{bb} values using concurrent radiosonde measurements of temperature and water vapor resulted in values which were much too high. On the other hand, the 10-11μ window channel temperatures approximated the concurrent reports of surface shelter temperatures. These results indicate that cirrus has a differential attenuation effect on 6.4-6.9μ and 10-11μ radiation. Understanding of this phenomenon is important to the interpretation of the 6.4-6.9μ observation in general, and bears heavily on many possible applications of the 6.7μ spectral region in particular. Author

N69-33746# Danish Meteorogical Inst., Charlottenlund.
PRELIMINARY REVIEW OF THE CLIMATE OF DENMARK: ATMOSPHERIC PRESSURE, WIND CONDITIONS, AIR TEMPERATURE, SUNSHINE, PRECIPITATION, AND HUMIDITY CHIEFLY DURING THE PERIOD 1931-60 [FORELOEBIG OVERSIGT OVER DANMARKS KLIMA: LUFTTRYK, VINDFORHOLD, LUFTTEMPERATUR, SOLSKIN, NEDBOERFORHOLD OG LUFTFUGTIGHED HOVEDSAGELIG I PERIODEN 1931-60]
Leo Lysgaard 1969 109 p In DANISH
(Rept-19) Avail: CFSTI

Monthly data for the years covered by this report are variously tabulated to show frequency, averages, extremes, variations in general, and periodic variations for several locations in Denmark. Explanations and summaries of the tables and a review of the climatology of Denmark are included. Transl. by K.W.

N69-33907# Hawaii Univ., Honolulu.
ANNOTATED BIBLIOGRAPHY OF PUBLICATIONS AND PAPERS RELEVANT TO HAWAIIAN WEATHER Final Data Report No. 11
P. C. Ekern, comp. and L. E. Worthley, comp. Jul. 1968 127 p refs
(Contract E-189-67)
(PB-183062; HIG-68-11) Avail: CFSTI CSCL 04B

The annotated bibliography has been compiled primarily to serve as a quick reference for people in Hawaii who are doing research on local weather problems. It is divided into two major sections, a subject index and an author index. The subject index is subdivided into general categories, such as Hawaiian rainfall, general, hurricanes, etc., and these are further broken down by year. Author (USGRDR)

N69-33908# National Hurricane Research Lab., Miami, Fla.
THE STRUCTURE OF HURRICANE DORA (1964)
Robert C. Sheets Dec. 1968 66 p refs
(PB-182886; TM-83) Avail: CFSTI CSCL 04B

Hurricane Dora was investigated by research aircraft for extended periods on September 4, 5, 7, 8, and 9, 1964. The storm was of hurricane strength throughout the investigation. The first research mission was executed when the storm was centered near 22N and 60W, and the last mission just before landfall on the northeast Florida coast. Most of the data collected were obtained at the low and middle levels. Analyses of the aircraft-recorded data are presented in the form of vertical and horizontal cross sections and some profiles. The synoptic features associated with the slightly unusual storm movement are discussed briefly, followed by a detailed examination of the changing radar structure for September 4 through 9 and the unusual thermal structure observed on September 4. Author (USGRDR)

N69-33909# Sandia Corp., Albuquerque, N. Mex.
EXTREME WINTER TEMPERATURES IN FAIRBANKS, ALASKA
M. B. Gens Dec. 1968 25 p refs
(PB-182944; SC-DR-68-759) Avail: CFSTI CSCL 04B

A study was made of the ambient temperatures in Fairbanks, Alaska, during the winter months (November through March). Twenty-one years of records were used. The data included the period of the lowest officially recorded temperature. The temperature was seen to fall below -40 degrees F at least once annually, below -50 degrees F during six of the years, and below -60 degrees F during two years. Author (USGRDR)

N69-33927# Institut Royal Météorologique de Belgique, Brussels. Inst. d'Hygiène et d'Epidémiologie.
ATMOSPHERIC POLLUTION, SMOKE AND SULFUR DIOXIDE [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX] Monthly Bulletin, Sep. 1968
1968 16 p In FRENCH and DUTCH
Avail: CFSTI

Tables are given on sulfur dioxide and smoke quantity (air pollution) measured in different weather stations in Belgium in September 1968. A brief description is given of the air sample apparatus. ESRO

N69-34016# Institut Royal Météorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS [OBSERVATIONS CLIMATOLOGIQUES] Monthly Bulletin, Feb. 1968
1968 15 p In FRENCH and DUTCH
Avail: CFSTI

Climatological data derived from observations made at the Royal Institute for Meteorology, Uccle (Belgium) in February 1968 are given. ESRO

N69-34036# Weapons Research Establishment, Salisbury (Australia).
BASIC ATMOSPHERIC PARAMETERS AS MEASURED BY FOUR FALLING SPHERE EXPERIMENTS AT WOOMERA, JULY TO NOVEMBER 1966
P. H. O. Pearson Feb. 1968 38 p refs
(WRE-TN-SAD-218) Avail: CFSTI

Four falling sphere experiments were conducted at Woomera from July to November 1966. These results form the fourth group obtained during the second year of firings in a series to measure the seasonal variation of density, temperature, pressure and winds shortly after sunset. Author

N69-34236# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS [OBSERVATIONS CLIMATOLOGIQUES] Monthly Bulletin, Mar. 1969
1969 15 p In FRENCH and DUTCH
Avail: CFSTI

Climatological data derived from observations made at the Royal Institute for Meteorology, Uccle (Belgium) in March 1969 are given. ESRO

N69-34261# National Environmental Satellite Center, Washington, D.C.
THE IMPROVEMENT OF CLEAR COLUMN RADIANCE DETERMINATION WITH A SUPPLEMENTARY 3.8 MU WINDOW CHANNEL
William L. Smith Jul. 1969 21 p refs
(NESCTM-16) Avail: CFSTI

Under cloudy conditions relatively large errors in calculated clear column radiances for Infrared Temperature Profile Radiometer (ITPR) scan elements can arise where the cloud height is highly variable and where the cloud emissivity varies with wavelength. A method for detecting such cloud conditions using supplementary 3.8 micron window observations was developed and tested using simulated ITPR observations deduced from Nimbus 2 high resolution infrared radiometer data. The clear column radiances derived with the aid of the 3.8 micron observations are much more precise than those calculated without this supplementary data. With 3.8 micron observations it appears possible to obtain more accurate clear column radiances for smaller areas and in regions of extremely high (but less than 100 percent) cloud cover. This knowledge should enable more accurate temperature soundings, down to the earth's surface, to be derived close to the centers of weather activity. Author

N69-34297# Air Force Cambridge Research Labs., Bedford, Mass.
ON THE MEASUREMENT OF LOW LEVEL HURRICANE WINDS BY AIRBORNE DUAL BEAM RADAR
Kenneth M. Glover Apr. 1969 19 p refs *Its* Instrumentation Papers No. 156
(AD-687750; AFCRL-69-0169) Avail: CFSTI CSCL 4/2

There has long been a need for a suitable airborne instrument for the remote measurement of wind speeds near the surface within hurricanes and typhoons. This study considers the applicability and implementability of several pseudo-Doppler radar methods of wind speed determination for hurricane reconnaissance missions. Useful measurements of the wind speed and wind direction profiles for any altitude region below the aircraft, appear to be feasible using two of the systems described. Author (TAB)

N69-34298# Air Force Cambridge Research Labs., Bedford, Mass.
ATMOSPHERIC TURBULENCE IN AND NEAR CUMULONIMBUS CLOUDS
V. S. Aleksandrov et al Apr. 1969 33 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 78, 1967 p 32–49
(AD-687342; AFCRL-69-0178; Trans-45) Avail: CFSTI CSCL 4/2

A summary is made of the modern theories concerning eddies in a Cb zone. Data concerning the structure of the turbulent zones inside and in the vicinity of Cb clouds are given according to the materials of special flight studies, as are the energy spectra of the vertical turbulent gusts of wind inside, below, and above the Cb clouds. The statistical characteristics of the disturbed motion of an aircraft in turbulent zones linked with Cb clouds are investigated. Author (TAB)

N69-34316# Finnish Meteorological Office, Helsinki.
ON THE WARMING OF THE TROPOSPHERE IN SPRING IN NORTH FINLAND
Erkki Laitinen 1969 50 p refs
(Contrib-72) Avail: CFSTI

Atmospheric temperature variations during April through June are examined using aerological observations made at Sodankylä Observatory. This material as well as the long-period screen temperature series show that the heating of the atmosphere is retarded during May despite the strongly increasing radiation balance of the system earth-atmosphere at the time of the disappearance of the snow cover during the same month. The heating process of the atmosphere is investigated by computing the terms in the energy balance equations. The advection of sensible heat in the atmosphere is computed as the residual from the energy balance equations. The heat advection decreases rapidly during spring and becomes negative during May. The moderate increase of the atmospheric temperature can therefore be explained as being chiefly dependent on the variation of the heat advection. The advection of sensible heat is also computed from aerological data. These results can be used as a qualitative check of the variation of heat advection as obtained from the balance equations. The change of the sign of heat advection implies the beginning of the summer monsoon, reflected for example in the sea level pressure distribution over the North European Continent and the adjoining sea areas. Author

N69-34373# Army Foreign Science and Technology Center, Washington, D.C.
DECODING AND SYNOPTIC INTERPRETATION OF INFRARED (IR) CLOUD COVER PHOTOGRAPHS
E. P. Dombkovskaya 7 May 1969 18 p refs Transl. into ENGLISH from Tr. Tsentr. Nauchn.-Issled. Gidrometeorol. (Leningrad), no. 11, 1967
(AD-688535; FSTC-HT-23-050-69) Avail: CFSTI CSCL 4/2

The article gives a brief description of infrared photographs taken by the Nimbus I meteorological satellite and examples of their interpretation; the materials for the article were taken from the American publication Nimbus I High Resolution Radiation Data Catalog and Users Manual, USA, January, 1965. The article begins with a brief discussion of the principles for interpreting such infrared photographs and then proceeds to a discussion of specific cases. Three of the photographs discussed are for the area of the USSR and one photograph is for the Greenland area. The interpretation is based on the use of aerosynoptic data and a comparison with maps. There is a discussion of the criteria used in interpreting such features as cyclones, warm fronts, cold fronts, and sea surface. The author then formulates four categories of cloud formations which are discussed in considerable detail: (1) cloud bands, (2) cloud vortices, (3) dense cloud shields, and (4) cloud formations with clearings. Author (TAB)

N69-34495# Space Instruments Research, Inc., Atlanta, Ga.
A PILOT STUDY OF THE IRREGULAR WINDS AT CHEMICAL RELEASE ALTITUDES Technical Report, 3 Jan.–3 Oct. 1968
C. G. Justus and J. B. Montgomery, III Kirtland AFB, N.Mex. AF Weapons Lab. May 1969 72 p refs
(Contract F29601-68-C-0040)
(AD-688619; AFWL-TR-68-132) Avail: CFSTI CSCL 4/1

Results are presented of a study of the irregular horizontal and vertical winds observed from chemical clouds released on 16-19 November 1966 from Yuma, Arizona; on 17 November 1965 from Barbados, West Indies; and on 17 May 1963 from Eglin Air Force Base, Florida. Author (TAB)

N69-34556# Weather Squadron (24th), Detachment 12, Sheppard AFB, Tex.
TERMINAL FORECAST REFERENCE FILE, SHEPPARD AFB, TEXAS
Mar. 1969 42 p revised
(AD-687884) Avail: CFSTI CSCL 4/2

The report revises Section I and Section II of Terminal Forecast Reference File written in August 1958. Author (TAB)

N69-34583# Israel Program for Scientific Translations, Ltd., Jerusalem.
EXPERIMENTAL STUDY OF METHODS FOR MEASURING LIQUID PRECIPITATION [EKSPERIMENTALNOE ISSLEDOVANIE METODOV IZMERENIYA ZHIDKIKH OSADKOV]
A. R. Konstantinov et al 1969 24 p refs Transl. into ENGLISH from Tr. Ukr. Nauch.-Issled. Gidrometeorol. Inst. (Leningrad), No. 41, 1964 p 163-185 Published for NSF and Dept. of Agr. *Its* Cat. No. IPST-5257
(TT-68-50432) Avail: CFSTI

Examined are some experimental methods for measuring liquid precipitation in flat and broken country using both standard and more accurate, modern instruments. Practical recommendations are given with a view to increasing the accuracy of liquid precipitation measurements. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-33430*# TRW Systems Group, Redondo Beach, Calif.
LUNAR MODULE/ABORT GUIDANCE SYSTEM (LM/AGS) DESIGN SURVEY. NASA/ERC DESIGN CRITERIA PROGRAM, GUIDANCE AND CONTROL
Sep. 1968 96 p
(Contract NAS12-110)
(NASA-CR-86189; TRW-06414-6008-T000) Avail: CFSTI CSCL 17G

A survey of the design and development of the abort guidance system for the Apollo lunar module is presented. The lunar module abort guidance system is a strapdown, all attitude, inertial guidance system being developed and produced for safely returning the astronauts to the command module in the unlikely event of a Primary Guidance, Navigation, and Control System (PGNCS) failure either during descent, while the lunar module is on the lunar surface, or during ascent from the lunar surface to the command module. The abort guidance system also provides a means of monitoring the performance of the PGNCS for fault detection. The evolution of the Abort Guidance System (AGS) design and the historical design development of subassemblies and software is summarized, and the major design problems that have developed to date are presented. Since the system is in the late stages of development, but has not yet been flight tested, it is possible that additional problem areas will appear, and design changes will be required. A detailed description of the major AGS subassemblies, software, and system level testing is also given. Author

N69-33699*# TRW Systems Group, Redondo Beach, Calif.
RADIO/OPTICAL/STRAPDOWN INERTIAL GUIDANCE STUDY FOR ADVANCED KICK STAGE APPLICATIONS. VOLUME 2: DETAILED STUDY RESULTS, TASKS 3 AND 4. PART 1: DERIVATION OF GUIDANCE AND CONTROL FUNCTIONAL AND PERFORMANCE REQUIREMENTS Final Report
Nov. 1968 274 p refs
(Contract NAS12-141)
(NASA-CR-86197; TRW-07398-6027-R0-00) Avail: CFSTI CSCL 17G

Results of a radio/optical/strapdown inertial guidance systems study for application to future unmanned space missions are reported. The primary objective was to evaluate the feasibility of the integrated modular design concept for the guidance and control of launch vehicles and spacecraft for unmanned space missions by means of analysis and design of a responsive system. Detailed study objectives were: to establish guidance and control requirements; to investigate possible guidance concepts to establish functional capabilities and limitations of the overall guidance system; to perform analyses to establish the significant performance characteristics of each component and subsystem; to perform a preliminary modular design of the radio/optical/strapdown inertial system so that specific components may be interchangeably combined into given operational systems; and to perform preliminary design studies of the inertial and electro-optical sensor subsystems and indicate areas of technology where state of the art advances are necessary. Author

N69-34263# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
SYSTEM SHAKEDOWN TEST (C2ON) NAS EN ROUTE STAGE A MODEL 1, FUNCTIONAL PACKAGE A (FLIGHT DATA PROCESSING) Final Report
Gilbert P. Boschert Aug. 1969 34 p
(NA-69-13) Avail: CFSTI

System shakedown tests of the National Airspace System Functional Package A were conducted. Planned investigations were conducted despite many system failure interruptions. Valuable information was obtained which expedited shakedown activities. Data collection, data reduction and test conduct methods for application to future First Article Center testing were examined. Reaction and impact of planned equipment failures upon system operation were also scrutinized. The test results produced the most suitable method for conduct of tests, the most acceptable method of data collection and reduction, and the conditions and circumstances under which failures of specific system components had an adverse impact upon system operations. At the conclusion of testing, it was determined that many discrepancies in system performance, and some deficiencies in system design, remained to be resolved. Author

N69-34411# Army Foreign Science and Technology Center, Washington, D.C.
SYNTHESIS OF A GYROSTABLIZED SYSTEM WITH OPTIMUM RESPONSE
L. E. Kanarev et al Apr. 1969 12 p refs Transl. into ENGLISH from Priborostroenie (Moscow), no. 2, 1968 p 81-85
(AD-688527; FSTC-HT-23-875-68) Avail: CFSTI CSCL 17/7

A Gyrostabilized System with optimum response is designed by the method of series synthesis. The analytical form of optimal control is derived and the conditions for its realization are described. Author (TAB)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-33273*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMIONIC FUEL IRRADIATION EXPERIMENT DESCRIPTION
Robert P. Migra, Leo ard J. Kaszubinski, and Robert L. Brown Washington Aug. 1969 48 p refs
(NASA-TM-X-1858) Avail: CFSTI CSCL 18J

An instrumented lead-type experiment for the irradiation of encapsulated fuel and insulator specimens at temperatures and fast neutron fluxes that simulate thermionic reactor conditions is described. Fast neutron fluxes are obtained by use of a dadmium and boron carbide shield to remove the thermal neutrons and a portion of the epithermal neutrons. Automatic temperature control of the fuel is obtained by varying a mixture of argon and helium gas in a thin annulus between the primary and secondary containment secondary containment barriers of the fuel capsule. Author

N69-33596# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Siebersdorf.
MEAN FUEL CYCLE COSTS OF NUCLEAR POWER REACTORS AT VARIABLE LOAD FACTOR [MITTLERE BRENNSTOFFZYKLUSKOSTEN VON KERNKRAFTWERKEN BEI VERAEDERLICHEM LASTFAKTOR]
H. Grumm and P. Nathschlaeger 1969 15 p In GERMAN
(SGAE-RT-22/1969) Avail: CFSTI

Three cost estimate models for nuclear power reactor fuel cycles are presented. Fuel management at a variable load factor is considered for: (1) a steady optimal operation with regularly spaced fuel element exchange per year; (2) a steady optimal operation with fuel element exchange only when found necessary; and (3) optimal operation with fuel element exchange if necessary for proper reactivities. Transl. by G.G.

N69-33703# Oak Ridge National Lab., Tenn. Neutron Physics Div.
MODIFICATION AND FURTHER DEVELOPMENT OF THE NUCLEON TRANSPORT CODE, NTC
D. C. Irving, H. S. Moran, and W. E. Kinney 4 Mar. 1969 53 p refs Sponsored by AEC
(ORNL-TM-1866) Avail: CFSTI

Several modifications to the Nucleon Transport Code NTC are described. Also, descriptions are provided for a few portions of the code which had previously been undocumented. Included in the report are the description of PREP, a data preparation routine; a generalized framework for the high-energy analysis program which handles the bookkeeping details and leaves the specialization to a particular problem to a few user-written routines; a listing of improvements made in the treatment of evaporation processes; the replacement of an older and incompletely documented version of 05R by the published version; the description of a general-purpose evaporation model program in 05R to treat inelastic scattering; and the preparation of a special version of NTC using a straightahead approximation. Author (NSA)

N69-33706# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
REPP: A THERMAL HYDRAULIC DESIGN CODE FOR WATER-COOLED REACTORS
R. M. Hiatt and C. Bromley, Jr. Mar. 1969 171 p refs
(Contract AT(45-1)-1830)
(BNWL-1013) Avail: CFSTI

The REPP is a digital computer method for designing pressure water and boiling water reactor cores within specified heat transfer and fuel centerline temperature limits. The method incorporates the Westinghouse W-2 and W-3 empirical correlations and a theoretical hot channel model to predict burnout conditions in a rod bundle. Two geometries are considered: rods in a triangular array, and rods in a square lattice. The heat transfer problem solved is a one-dimensional analysis. Pressure drop is considered for four types of fuel-pin spacers. Variable heat generation rate through the fuel-pin and sintering in low density fuels are also included. Author (NSA)

N69-33709# Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.
ENGINEERING ASPECTS OF IRRADIATION EMBRITTLEMENT OF REACTOR PRESSURE VESSEL STEELS: REVIEW OF THE ITALIAN WORK
R. Gasparini (ENEL), G. Petrangeli (CNEN), and F. Rossi 1968 29 p refs Presented at AIEA Working Group on Eng. Aspects of Irradiation Embrittlement of Reactor Pressure Vessel Steels, Vienna, 2–4 Oct. 1967
(SORIN-139) Avail: CFSTI

The behavior of steel in cylindrical pressure vessels having an axial crack and pressurized with an incompressible fluid is studied to determine the influence of geometrical parameters on the elastic stress field and failure mode. Conclusions presented are: (1) Silicon iron appears to be more damage sensitive than titanium or aluminum iron. (2) The presence of free nitrogen in the iron causes a remarkable reduction of ductility after irradiation. (3) The complete stabilization of N+C (by precipitation with Ti) reduces the damage sensitivity of iron. (4) Prolonged annealing at 300°C has been observed to produce secondary reembrittlement in both fully stabilized and nonaging specimens. Tables and charts summarizing the results are presented. F.O.S.

N69-33726# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
PHYSICO-CHEMICAL STUDIES OF Fe–Cr–Al-CLAD FUEL SYSTEMS
K. M. Bohlander and H. S. Edwards Sep. 1968 53 p refs
(Contract AT(40-1)-2847)
(GEMP-672) Avail: CFSTI

Evidence is presented which supports the assumption that aluminum diffuses from clad to core and partially reduces UO_2, and that the freed uranium diffuses to the surface. Capsules containing no Al showed no surface U after 1000 hours at 1200°C. No definite relationship was determined between Al concentration in the clad (in the range 4 to 10 wt %) and the amount of surface U found. Oxygen liberated during the reduction of UO_2 forms an Al_2O_3 barrier at the cladding-core interface. This stable compound inhibits subsequent diffusion of Al into the UO_2-containing core and consequently limits the quantity of U formed. Diffusion barriers

of Cr between clad and Cr–UO_2 cermet cores have the more desirable effect of inhibiting diffusion of Al into the fuel from the start of the test. When cores were fabricated from $UO_{1.969}$ (that is, a composition containing $UO_{2.00}$ plus free U) neither Cr nor Al_2O_3 barriers were effective in preventing outward diffusion of U which was present at the start of a test. Author (NSA)

N69-33744# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

A FORTRAN PROGRAM FOR CALCULATION OF THE THERMODYNAMIC CYCLE AND THE COOLING CYCLE OF A STEAM COOLED NUCLEAR REACTOR

H. Spicker Dec. 1967 107 p refs In GERMAN
(KFK-716; EUR-3727.d) Avail: AEC Depository Libraries

A short description of the heating circuits for steam cooled reactors is given; flow diagrams are shown for direct and indirect cycles. Determination of expansion curves is discussed; heat balance and mixture balance equations are given for the cooling cycle. The overall organization of a computer program for calculating thermodynamic quantities is described; detailed flow diagrams are included. Input/output format is given; subroutines are described. A sample problem is included. The program is written in FORTRAN for the IBM 7074. NSA

N69-33759# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

RELATIVE INHALATION HAZARDS FROM NUCLIDES PRESENT IN FRESH IRRADIATED FUEL

R. A. Hilliar Jul. 1968 10 p refs
(RD/B/N1143) Avail: CFSTI

Tables are presented in which high burn-up civil AGR fuel is described in terms of the hazard associated with an aerosol having the same nuclear composition as the fuel. An aerosol of one microgram per cubic meter is shown to have nearly 7,000 times the maximum permissible concentration for an occupationally exposed worker, but that this hazard is associated with relatively few nuclides, mostly with long half lives. Since in most situations the relative proportion of the nuclides in a release will be different from that in the fuel itself, the tables are presented in a form which enables specific differential release data to be incorporated. Author

N69-33791# Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.

PROGRESS ON HIGH-TEMPERATURE FUELS TECHNOLOGY DURING NOVEMBER 1968–JANUARY 1969. TASK 6 Quarterly Report

Donald L. Keller and Walston Chubb Feb. 1969 74 p refs
(Contract W-7405-ENG-92)
(BMI-1859) Avail: CFSTI

Measurements of the amount of gas retained in nuclear fuels after irradiations at temperatures from 1470 to 1700°C confirmed the belief that swelling at these temperatures is caused by gas retention. The measurements also support the theory that the phenomenon called saturation of swelling is caused by release of gas at the same rate as it is being generated. A sample of UN which showed saturation of swelling at a burnup near 0.8×10^{20} fissions per cm^3 contained less than 3 percent of its fission gas after a burnup of 2.4×10^{20} fissions per cm^3. A sample of UO_2 which showed saturation of swelling at a burnup near 1.0×10^{20} fissions per cm^3 contained 21 percent of its fission gas after a burnup of 1.9×10^{20} fissions per cm^3. A sample of UC which did not show saturation of swelling after a burnup of $2.0 \times {}_{10}0^{20}$ fissions per cm^3 contained 58 percent of its fission gas at this burnup. Uranium monocarbide exhibited 37 percent elongation in tension in creep tests at 1400°C. NSA

N69-33792# Gulf General Atomic, San Diego, Calif.

GATT: A THREE-DIMENSIONAL FEW-GROUP NEUTRON DIFFUSION THEORY PROGRAM FOR A HEXAGONAL-Z MESH

H. Kraetsch and M. R. Wagner 1 Jan. 1969 68 p refs
(Contract AT(04-3)-167)
(GA-8547) Avail: CFSTI

GATT is a three-dimensional few-group neutron diffusion theory program for calculating the detailed spatial flux and power distribution for reactors with an hexagonal core configuration. The code uses a uniform triangular mesh in the horizontal mesh planes and assumes a relatively simple region structure in the axial direction. The code was designed to represent the special patch-type core structure of the high-temperature gas-cooled gas type reactor. GATT is written in FORTRAN 4 for Univac 1108. Author (NSA)

N69-33794# Atomics International, Canoga Park, Calif. Liquid Metals Engineering Center.

LIQUID METALS ENGINEERING CENTER (LMEC) Semiannual Technical Progress Report, Jul. – Dec. 1968

Dec. 1968 281 p refs
(Contract AT(04-3)-700)
(LMEC-69-1) Avail: CFSTI

Progress is reported on the activities of the Liquid Metal Engineering Center (LMEC) in support of the LMFBR development program. Operating and functional requirements for large valves for LMFBR were established. Design parameters for liquid metal pumps were selected. Post operation examination of HNPF valves was continued. Existing and proposed LMEC test facilities and test rigs were evaluated. Draft standards were prepared for the sodium-cooled reactor vessel, circulating cold trap, 100 to 15,000 gpm mechanical free-surface Na pump, an ac electromagnetic Na pump, Na blocking valve, and Na quality. Historical Na reactor failure data were collected and are being evaluated. A microfilm data storage and retrieval system were acquired for storing this data. Development of the Quality Assurance Manual continued. A system was implemented whereby purchase requisitions are reviewed for material quality. Reconstruction of the Sodium Components Test Installation main steam line was continued. NSA

N69-33807# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

FIELD-ION MICROSCOPY OF URANIUM DIOXIDE

R. Morgan Nov. 1968 14 p refs Presented at the 15th Field Emission Symp., Bonn, Sep. 1968 Submitted for publication
(RD/B/N1230) Avail: CFSTI

Procedures are described for the preparation and imaging of uranium dioxide specimens by field-ion microscopy. A two-stage preparation procedure is used, consisting of a chemical polish to obtain the correct profile, followed by electro-polishing. Hydrogen-ion microscopy was found satisfactory, but experiments with neon and argon image gases are also described. Author

N69-33808# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

THE RELEASE OF Kr 85 FROM IRRADIATED URANIUM DURING OXIDATION IN CARBON DIOXIDE BETWEEN 500 DEG AND 700 DEG C

D. A. Hilton Feb. 1969 16 p refs Submitted for publication
(RD/B/N1008) Avail: CFSTI

The release of Kr^{85} during the oxidation of irradiated reactor grade uranium in carbon dioxide was studied in the temperature range 500°–700°C. The active gas was monitored over 10 second intervals using a β-scintillation flow counter coupled to a

multichannel analyser which was used as a multiple scaler. In the initial parabolic stage of oxidation the rate of Kr^{85} release is also parabolic over the temperature range 500°–625°C and both processes have the same activation energy. Over longer periods of oxidation Kr^{85} is released as a result of oxide cracking. The activity released is generally proportional to the weight gain and this is probably due to the rate of crack propagation being equal to the rate of oxide growth at the metal-oxide interface. Up to 75% of the Kr^{85} originally present in the metal can be retained by the non-adherent oxide and this activity is completely released by air oxidation above ≈350°C. Partial oxidation in the β-phase results in the additional release of Kr^{85} during cooling due to disruption of the oxide as a consequence of the β-α phase change. Author

N69-33818# Institute of Technology, Helsinki (Finland).
ON THE DERIVATION OF NEW APPROXIMATIONS FOR THE MONOENERGETIC BOLTZMANN EQUATION USING A SELF-ADJOINT VARIATIONAL PRINCIPLE
Heikki Kelli and Pekka Jauho 1968 16 p refs *Its* ACTA Polytech. Scand., Phys. Nucl. Ser. 61
(PB-183064; APS-PH-61) Avail: CFSTI CSCL 18K

The paper demonstrates an application of the self-adjoint variational principle for the derivation of new approximations for the monoenergetic Boltzmann equation in the neutron transport theory. The criticality problem of a bare homogeneous one-dimensional slab reactor is used as an example. A trial function with one free parameter k is chosen for the even portion of the directional flux, the respective approximation is derived and solved with various k values and the critical half-thickness are compared with the results of the ordinary S sub n approximations. In the appendix some results for the one-dimensional spherical reactor are listed. Author (USGRDR)

N69-33832# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plant Div.
REACTIVITY COMPENSATION BY MEANS OF MOBILE LATTICES
A. Krettova, V. Valenta, and K. Vlachovsky Oct. 1968 25 p refs
(ZJE-42) Avail: AEC Depository Libraries

The use of horizontal control lattices to regulate reactivity in gas-cooled heavy water-moderated power reactors is analyzed. The lattices are designed to move in the direction of the fuel channels. The compensation effect of a lattice depends on the thickness, composition, and position. NSA

N69-33833# Technische Univ., Berlin (West Germany). Inst. fuer Kerntechnik.
DETERMINATION OF THE THERMAL SPECTRUM OF THE SUR 100 BE WITH A NEUTRON CHOPPER [BESTIMMUNG DES THERMISCHEN SPEKTRUMS DES SUR 100 BE MIT EINUM NEUTRONENCHOPPER]
G. Bartsch, W. Klose, and U. Wesser Sep. 1968 95 p refs In GERMAN
(TUBIK-10) Avail: AEC Depository Libraries

Use of a neutron chopper to measure the thermal neutron spectrum in the SUR 100 BE reactor is described. Correction factors used in the time-of-flight measurements are discussed. The construction of the chopper outlined; the experiment arrangement is shown schematically. Measurement techniques, data acquisition and processing, and error analyses are detailed. Results of the chopper measurements are given; data are presented graphically and tabularly. NSA

N69-33853# Argonne National Lab., Ill. Reactor Engineering Div.
ELEMENTARY NEUTRONICS CONSIDERATIONS IN LMFBR DESIGN
G. H. Golden Mar. 1969 68 p refs
(Contract W-31-109-ENG-38)
(ANL-7532) Avail: CFSTI

Elementary neutronics considerations in the design of liquid-metal-cooled fast breeder reactors are described to provide a basic understanding to the scientist or engineer who does not have a background in fast-reactor neutronics. The discussion is not intended to be either a rigorous treatment of the specialized subject of fast reactor physics, or an LMFBR design manual, so rigor is sacrificed frequently for clarity at the desired level. Thus many of the points made are "design-acceptable" approximations that are not absolutely accurate. The subject material is a progression from basic physics concepts to the design of real LMFBRs: flux spectra and cross-section variation with energy in fast reactors; aspects of multi-group calculations in diffusion theory; the significance of breeding and conversion ratios, specific power and doubling time; radial core zoning; refueling (i.e., time-dependent behavior); a discussion of reactivity effects as related to safety, with specific reference to sodium void, Doppler, and expansion effects; and current design approaches. Author (NSA)

N69-33887# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
CONSIDERATIONS ON THE CREEP OF UO SUB 2 UNDER NEUTRON RADIATION [UEBERLEGUNGEN ZUM KRIECHEN VON UO SUB 2 UNTER NEUTRONENBESTRAHLUNG]
D. Brucklacher, W. Dienst, and F. Thuemmler Jul. 1968 24 p refs In GERMAN; ENGLISH summary
(KFK-817) Avail: AEC Depository Libraries

The corresponding creep rates for a tension of 2 kg/mm^2 were estimated and compared to the creep rate of unirradiated uranium. Considerations of the mechanism underlying the acceleration of creep under irradiation are based on the well-founded assumption that within the examined temperature range (≤1,300°C) the creep rate is primarily determined by quasi-viscous flow caused by diffusion. The diffusion promoting influence of various lattice defects caused by irradiation is estimated quantitatively. The results show that the literature information on an increased creep rate following irradiation can only be fully explained with the help of thermal spikes which accompany the fission of uranium. From these considerations it can be concluded that under the operating conditions of fast power reactors the creep rate of UO_2 fuel under a pressure of 2 kg/mm^2 equals at least the linear swelling rate caused by solid and included gaseous fission products. Thus, the total fuel pore volume is available for swelling, if the fuel canning is able to resist the indicated pressure in the fuel. Author (NSA)

N69-33888# McDonnell-Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.
PLUTONIA/CURIA COMPATABILITY TESTING Quarterly Report, 10 Oct.–31 Dec. 1968
J. D. Watrous Jan. 1969 17 p refs
(Contract AT(45-1)-2138)
(DAC-60777; QR-1) Avail: CFSTI

Safe use of radioisotope fuels requires knowledge of the capability of materials to contain the fuel. Five refractory metals and alloys (W, Mo, Re, Mo–50 Re, and W–30 Mo–30 Re) were procured for compatibility testing. Capsules were machined radiographed, helium leak-checked, and dye-penetrant examined. Plutonia-238 pellets were cold-pressed, vacuum-sintered and loaded into molybdenum capsules which were electron-beam welded without any external contamination. Author (NSA)

N69-33898# Commissariat à l'Energie Atomique, Marcoule (France). Centre de Production de Plutonium.
STUDY OF RADIOACTIVITY DIFFUSION FOR BITUMEN-COATED BLOCKS PRODUCED BY AN INDUSTRIAL COATING PLANT [ETUDE DE LA DIFFUSION DE LA RADIOACTIVITE DE BLOCS D'ENROBES BITUMINEUX EN PROVENANCE D'UN ATELIER D'ENROBAGE INDUSTRIEL]
Jean Rodier and Guy Lefillatre Apr. 1969 28 p In FRENCH; ENGLISH summary
(CEA-R-3743) Avail: CFSTI

The solidification by bitumen of chemical coprecipitation sludges from the Marcou waste treatment station has been studied in the laboratory and has led to the construction of an industrial coating plant. The quality of the coated materiel obtained has been controlled by the lixiviation test carried out with ordinary water and with sea-water on 45 ml laboratory samples and on industrial coated blocks of 150. Tests on blocks of such a size have necessitated the installation of three special tanks. Two, each of 2000 capacity, contain ordinary water and sea-water which was continuously recycled at a rate of 2.5 cm/hr and renewed periodically. In the third tank having a capacity of 11 000, the coated block was buried in earth and sprinkled with ordinary water in view of studying the migration of radioelements in soil. The results of these tests confirm those obtained during the laboratory experiments. Author (ESRO)

N69-33902# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
SUNSPHER, SUNCYL PROGRAMS FOR AN APPROXIMATION OF TRANSPORT EQUATION IN SHIELDING OF NUCLEAR REACTOR [SN PRIBLIZENI TRANSPORTNI ROVNICE VE STINENI JADERNEHO REAKTORU, PROGRAMY SUNSPHER, SUNCYL]
J. Burian Feb. 1969 20 p refs In CZECH.
(UJV-2125-R) Avail: AEC Depository Libraries

The SUNSPHER and SUNCYL computer programs are described which calculate neutron fluxes in multilayer shields of nuclear reactors by Carlson S_n approximation. In spherical geometry the degree of expanding the flux is variable as well as the degree of anisotropic scattering. In cylindrical one dimensional geometry the anisotropic scattering in transport approximation is supposed and the degree of angular terms is variable. Input, output and an example of calculation are shown. The codes are in ALGOL language for the GIER computer. Author (NSA)

N69-33903# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
SHORTENING OF DETECTOR SIGNALS WITH PASSIVE FILTERS FOR PILE UP REDUCTION: CALCULATIONS AND EXPERIMENTAL
G. Amsel, R. Bosshard, and C. Zajde Feb. 1969 70 p refs
(LAL-1211) Avail: AEC Depository Libraries

A method is described for the shortening of particle detector signals. Unipolar pulses may be obtained of duration shorter than that of the physical phenomenon taking place in the detector. Iterative passive filters of the bridged T type are used, yielding a constant resistive impedance (for example 50Ω–50Ω). The transfer function of such a filter may approximate, to within a constant factor, the inverse of the transfer function equivalent to the output of the detector. The design and the very simple construction and use of such filters are described, and numerous results are shown. Thus for a 56 AVP photomultiplier and a plastic scintillator the width at 10% of the maximum of the signal is reduced from 17.5 ns to 8.5 ns. NaI(Tl), anthracene, and semiconductor detectors are also considered. Author (NSA)

N69-33905# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plant Div.
STEEL PRESSURE VESSEL FOR NUCLEAR REACTORS
Stanislav Stepanek Jun. 1969 20 p refs
(ZJE-36) Avail: AEC Depository Libraries

The design parameters and fabrication techniques for the Bohunice Power Reactor Unit 1 pressure vessel are presented. The standards established for pressure vessels for other gas-cooled heavy water-moderated natural uranium fueled power reactors are analyzed. 9 references. Author (NSA)

N69-33924# Commissariat à l'Energie Atomique, Chuscian (France). Centre de Production du Plutonium.
IRRADIATION TESTS ON BITUMEN AND BITUMEN COATED MATERIALS [ESSAIS D'IRRADIATION DE BITUME ET D'ENROBES BITUMEUX]
René Tabardel-Brian, Jean Rodier, and Guy Lefillatre Apr. 1969 34 p refs In FRENCH; ENGLISH summary
(CEA-R-3730) Avail: CFSTI

The use of bitumen as a material for coating high-activity products calls for prior study of the resistance of bitumen to irradiation. After giving briefly the methods of preparation of bitumen-coated products, this report lists the equipment which has been used for carrying out the β and γ irradiations of these products, and gives the analytical results obtained as a function of the dose rates chosen and of the total integrated dose. Finally, some conclusions have been drawn concerning the best types of bitumen. Author (ESRO)

N69-33985# Junta de Energia Nuclear, Madrid (Spain).
STUDY OF RESONANCE ABSORPTION IN HOMOGENEOUS NUCLEAR REACTORS [ESTUDIO DE LA ABSORCION DE RESONANCIA EN REACTORES NUCLEARES HOMOGENEOS]
J. L. de Francisco Sáinz 1967 164 p refs In SPANISH
(JEN-198-DF/I-60) Avail: CFSTI

An attempt was made to solve one of the problems involved in nuclear reactor computation, i.e., capture resonances of the cross sections for a number of heavy elements. The collision parameters, interference between potential and resonant dispersion, Doppler effect, transport equation, approximations and numerical results are discussed. ESRO

N69-33990# Los Alamos Scientific Lab., N. Mex.
DIGITAL COMPUTER FLOW RATE CONTROL SYSTEM
Howard B. Demuth 9 May 1969 59 p refs
(Contract W-7405-ENG-36)
(LA-4123) Avail: CFSTI

The application of the on-line computer system incorporated in the Ultra High Temperature Reactor Experiment is described. The primary and secondary coolant flow rate control is discussed in detail, with particular attention given to the control-system stability and reliability as shown by analysis, and by control system tests conducted during flow tests of the reactor coolant systems. The equipment associated with the control system, the computer programming, and program checking features, and test results are described. Author (NSA)

N69-33995# Institutt for Atomenergi, Halden (Norway).
IN-CORE STUDY OF FUEL/CLAD INTERACTION AND FUEL CENTRE TEMPERATURE
G. Kjaerheim and E. Rolstad Jan. 1969 36 p refs
(HPR-107) Avail: AEC Depository Libraries

Differential transformers and tungsten–rhenium alloyed thermocouples have been used extensively to study the thermal and

dimensional behaviour of fuel rods under irradiation. The differential transformers have been used to measure fuel and cladding length changes. The results have also provided a considerable amount of information on diametral fuel expansion. Permanent dimensional changes have been observed, both in the diametral and axial direction. A mechanism for ridge formation has been proposed, taking into account both the hourglass shape of the pellets, frictional forces and the axial forces working between the pellets. Local axial and hoop strain concentrations are judged, under certain circumstances, to represent a serious hazard to cladding integrity. Measurements have been made on rods containing both flat and dished sintered UO_2 pellets and vibratorily compacted fuel. The thermocouples have been used to measure center fuel temperatures of sintered uranium oxide, mixed thorium oxide–uranium oxide, and vibratorily compacted uranium oxide. Author (NSA)

N69-34002# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
OXIDATION-REDUCTION OF PLUTONIUM IN THE TREATMENT OF SPENT FUELS
A. Chesne [1968] 21 p refs Transl. into ENGLISH from Bull. Inform. Sci. Tech. (Paris), no. 127, Jun. 1968 p 27–33
(RFP-Trans-55) Avail: CFSTI

Redox properties of plutonium were reviewed in the framework of the reprocessing of spent fuels. Equilibria between Pu(III)–Pu(IV) and PU(IV)–Pu(VI) related to acidity and nitrous acid concentration were considered. The effects of nitric acid radiolysis product on aqueous plutonium chemistry were emphasized. Author (NSA

N69-34048# Battelle-Northwest, Richland, Wash.
GASIFICATION OF REACTOR GRAPHITE WITH CARBON DIOXIDE AND STEAM
K. Hedden and H. Lowe [1968] 24 p Transl. into ENGLISH from Carbon (England), no. 5, Sep. 1967 p 339–353
(BNWL-tr-27) Avail: CFSTI

The gasification of nuclear graphite with CO_2 in the pressure range of 0.1 to 1 atm CO_2 and 0 to 0.7 atm CO at temperatures between 980 and 1120°C was investigated in a batch operated recirculation reactor. A rate equation of the Langmuir–Hinshelwood type was not suited to represent the experimental results, because small CO pressures were found to have a relatively stronger inhibiting effect than high CO pressures. The same graphite was used to study the CO_2–C reaction with small partial pressures of CO_2 ranging from 0.4 to 2 mm Hg in the presence of 0 to 2 mm Hg CO in He as a carrier in a continuously operated recirculation reactor at a total pressure of 1 atm. The CO inhibition was considerably stronger than calculated from the rate equation which was determined in the high pressure range. Moreover, the inhibition by a definite CO content decreased with increasing partial pressure of CO_2. Author (NSA)

N69-34054# National Reactor Testing Station, Idaho Falls, Idaho.
LOFT ENGINEERED SAFETY SYSTEMS INVESTIGATIONS
K. A. Dietz, ed. Apr. 1969 85 p refs
(Contract AT(10-1)-205)
(IDO-17258) Avail: CFSTI

Two types of engineered safety systems, emergency core coolant systems and containment safety systems, are utilized to mitigate or arrest the consequences of a reactor loss-of-coolant accident. A program plan designated the LOFT Engineered Safety Systems Investigations program was developed to provide verified analytical techniques that will strengthen the technical basis for the design and assessment of both types of engineered safety systems. The program consists of integrated analytical and experimental work. The experimental work consists of several programs designed to study the various processes occurring during the loss-of-coolant accident, either alone or in sequence. The experimental work culminates in a series of integral tests, during each of which the total sequence of the loss-of-coolant accident (including action of the engineered safety systems) is simulated in a small pressurized water reactor system. The detailed implementation of the total program is given in Parts A through K, which are technical descriptions of the individual smaller programs. Author (NSA)

N69-34055# National Reactor Testing Station, Idaho Falls, Idaho.
REACTOR SYSTEMS RESPONSE ANALYTICAL DEVELOPMENT PROGRAM
J. E. Anderson and L. J. Ybarrondo Apr. 1969 44 p refs
(Contract AT(10-1)-205)
(IDO-17258A) Avail: CFSTI

The analytical program for predicting and evaluating the response of water-cooled reactor systems to a loss-of-coolant accident is divided into three major mass and energy redistribution processes: (1) primary coolant system thermal and hydraulic response; (2) primary system structural response; and (3) containment atmosphere thermodynamic response resulting from primary system decompression. Analytical model development tasks are identified, and the specific solution approaches to be followed in model development are discussed. NSA

N69-34056# National Reactor Testing Station, Idaho Falls, Idaho.
FISSION PRODUCT BEHAVIOR ANALYTICAL DEVELOPMENTAL PROGRAM
D. H. Walker Apr. 1969 26 p refs
(Contract AT(10-1)-205)
(IDO-17258B) Avail: CFSTI

The LOFT program for identifying or developing analytical models to describe fission product behavior and for identifying and planning experiments to test the capabilities and limitations of these models is discussed. The output from the program will be analytical models whose capabilities and limitations have been tested by experiment. The models are needed for assessment of the radiological hazards which could result from a loss-of-coolant accident in a pressurized water nuclear reactor plant. More specifically, models are needed to predict the magnitude of fission product release to the containment atmosphere and to predict the subsequent rates for fission product deposition in the containment under natural response conditions (no containment safety systems), for the active fission product removal from the containment atmosphere by containment safety systems, and for the fission product leakage to the environment. Author (NSA)

N69-34057# National Reactor Testing Station, Idaho Falls, Idaho.
SEMISCALE BLOWDOWN AND ECC
H. D. Curet and R. K. House Apr. 1969 49 p refs
(Contract AT(10-1)-205)
(IDO-17258C) Avail: CFSTI

The blowdown and emergency core cooling studies, also referred to as the Semiscale Blowdown Program, compose an experimental program to investigate the hydraulic, thermodynamic, and mechanical behavior of a pressurized water reactor system during a loss-of-coolant accident. The investigations are being conducted in simulated reactor systems one-tenth the linear dimensions of a 1000 MW(e) commercial pressurized water reactor. Core heat addition is simulated electrically and engineered safety systems, such as emergency core cooling injection, are incorporated in the model systems. The objectives and status of the program are summarized. Author (NSA)

N69-34058# National Reactor Testing Station, Idaho Falls, Idaho.
SCOPING EMERGENCY COOLING HEAT TRANSFER (SECHT) TESTS PROJECT
Apr. 1969 22 p ref
(Contract AT(10-1)-205)
(IDO-17258SD) Avail: CFSTI

The SECHT Tests Project consists of four series of scoping experimental investigations into emergency core cooling phenomena in which electrically heated rods are used to simulate nuclear fuel elements. Rods having radial dimensions approximately equal to those of commercial power plant fuel elements, but of shorter length, are assembled into small-scale arrays for the tests. The project also includes heater rod development and evaluation. The SECHT testing program objectives and accomplishments are summarized. Author (NSA)

N69-34059# National Reactor Testing Station, Idaho Falls, Idaho.
PRESSURIZED WATER REACTOR: FULL-LENGTH EMERGENCY COOLING HEAT TRANSFER (PWR-FLECHT) TESTS PROJECT
Apr. 1969 15 p refs
(Contract AT(10-1)-205)
(IDO-17258E) Avail: CFSTI

PWR-FLECHT is an experimental program to investigate the thermal response of PWR fuel to the injection of emergency core coolant following a loss-of-coolant accident. The tests are being conducted with full-size, electrically heated, simulated fuel pins in 49- and 100-rod arrays. The objectives of the FLECHT-PWR project are: (a) to provide experimental data for development of a one-dimensional core thermal response model for emergency core coolant injection, (b) to develop empirical ECC correlations for general use in calculating ECC's performance, and (c) to provide early ECC demonstration tests on Zircaloy cladding. Author (NSA)

N69-34060# National Reactor Testing Station, Idaho Falls, Idaho.
FUEL HEATUP SIMULATION TESTS (FHUST)
H. D. Curet, P. R. Davis, R. K. House, R. T. Jensen, and T. J. McGrath Apr. 1969 38 p refs
(Contract AT(10-1)-205)
(IDO-17258F) Avail: CFSTI

The FHUST program is an experimental program to investigate the thermodynamic and mechanical behavior of pressurized-water-reactor fuel pins under simulated loss-of-coolant accident conditions with and without emergency core coolant injection. The major portion of the program consists of core heatup studies to determine the core heat transfer behavior before ECC injection; the remaining portion of the program consists of tests to determine the capability of ECC injection to terminate the core temperature transient for design and degraded ECC system operation. The investigations are being conducted using test configurations having from 9 to 232 pins, both with and without simulation of internal structures such as control rods, fuel element canisters and support structures. Electrical heating is used in all experiments to model the decay heat and stored energy of standard reactor fuel pins. The FHUST program accomplishments and projected activities are summarized. Author (NSA)

N69-34061# National Reactor Testing Station, Idaho Falls, Idaho.
LOFT INSTRUMENT DEVELOPMENT SUPPORT PROGRAM
W. B. Klinger Apr. 1969 21 p refs
(Contract AT(10-1)-205)
(IDO-17258G) Avail: CFSTI

The program was established to provide the verified measurement capability required to meet the experimental measurement of the LOFT integral tests and the LOFT small-scale separate effects tests. Since the acquisition of experimental information concerning the thermal, hydraulic, and mechanical processes in a loss-of-coolant accident is the principal objective of these tests, they can be conducted successfully only if adequate measurement capability is available. The experimental measurement requirements for the LOFT integral tests are given in IDO-17258 K. Instrumentation development is limited to those measurements which cannot be provided by commercially available instrument systems. The development is directed toward the detection device (transducer) and connecting cables. Commercially available signal conditioners are to be utilized where possible. Author (NSA)

N69-34062# National Reactor Testing Station, Idaho Falls, Idaho.
FISSION PRODUCT SAMPLING AND DECONTAMINATION DEVELOPMENT PROGRAM
R. J. Schultz and D. H. Walker Apr. 1969 38 p refs
(Contract AT(10-1)-205)
(IDO-17258I) Avail: CFSTI

Coatings for protecting the concrete missile shield of the LOFT containment vessel from penetration by steam and fission products are to be developed and tested in addition to methods of decontaminating the containment following the LOFT nuclear tests. The principal facility utilized in this program is the Contamination-Decontamination Experiment (CDE) facility The CDE facility is basically an 86 ft^3 tank used to represent a containment vessel. The tank is in a hot cell so that highly radioactive fission products can be employed. The fission products are introduced into simulated accident environments to provide samples for developing and testing analytical techniques and to contaminate samples for decontamination studies. The program has been divided into four areas of study: (a) fission product sampler development; (b) sample analysis and handling techniques; (c) protective coatings; and (d) decontamination techniques. Author (NSA)

N69-34063# National Reactor Testing Station, Idaho Falls, Idaho.
ORNL-LOFT FISSION PRODUCT SUPPORT PROGRAM
G. B. Matheney, G. W. Parker (Oak Ridge Natl. Lab.), and D. H. Walker Apr. 1969 34 p refs
(Contract AT(10-1)-205)
(IDO-17258J) Avail: CFSTI

The major experimental areas in this program and the uses of the experimental data are: (1) fission product buildup in the fuel pin plenum during reactor operation; (2) fission product release upon cladding failure; (3) fission product transport through the reactor system to the containment; and (4) time-dependent fission product depletion and changes in the chemical state of radioiodine in the containment atmosphere and the effect of engineered containment safety systems on these processes. Fission product buildup in the fuel pin plenum will be studied in the laboratory with equipment constructed specifically for this purpose. Fission product release on cladding rupture, fission product transport to the containment, and fission product distribution in the containment will be studied in the Containment Research Installation (CRI) facility. Author (NSA)

N69-34064# National Reactor Testing Station, Idaho Falls, Idaho.
LOFT INTEGRAL TEST PROGRAM
J. Dugone, D. E. Solberg, and D. H. Walker Apr. 1969 119 p refs
(Contract AT(10-1)-205)
(IDO-17258K) Avail: CFSTI

The LOFT Integral Test Program to be performed with the Loss-of-Fluid Test (LOFT) Facility consists of a series of loss-of-coolant tests, in which the emergency core cooling system is operated both at design and degraded performance conditions.

Other engineered safety systems, such as the containment pressure reduction spray system and the containment filter system, also will be operated and tested. The general objectives of the LOFT Integral Test Program are: (1) to verify the capability of analytical methods to predict the loss-of-coolant accident response of large power reactors, the performance of engineered safety systems, and the margins of safety inherent in their performance; and (2) to identify any unexpected events or thresholds not presently accounted for in the analysis of plant response or in the design of engineered safety systems. Author (NSA)

N69-34066# Argonne National Lab., Ill. Reactor Engineering Div.

DEVELOPMENTS IN THE ELIMINATION OF BORON LOSS FROM URANIUM DIOXIDE-STAINLESS STEEL DISPERSION FUEL PLATES FOR THE ARGONNE ADVANCED RESEARCH MARK 1 CORE

Victor C. Pearson Oct. 1968 67 p refs
(Contract W-7405-ENG-38)
(ANL-7477) Avail: CFSTI

Fabrication of the Type 347 stainless steel-clad stainless steel-UO_2 cermet fuel and Ni-coated ZrB_2 particle burnable poison is described for the Mark 1 core of the Argonne Advanced Research Reactor. Irradiation testing results are presented. NSA

N69-34069# Gulf General Atomic, San Diego, Calif.

FREVAP-8 COMPUTER CODE FOR CALCULATING THE RELEASE OF METALLIC FISSION PRODUCTS

L. R. Zumwalt, V. H. Pierce, J. E. Welch, and J. H. Norman 15 Jun. 1968 182 p refs
(Contract AT(04-3)-633)
(GA-8476) Avail: CFSTI

The analytical formulation of the FREVAP computational method is presented. The FREVAP-8 computer program developed from the FREVAP formulation and written for the Univac 1108 computer is listed. A sample problem typical of calculations made using the code to estimate core release of the condensable fission product species for high-temperature gas-cooled reactors is described. Detailed FORTRAN listings and flow diagrams of the main program and significant subroutines are included. The list of program variable labels and variable names used in the FREVAP formulation is tabulated for cross reference. The sample problem represents a typical HTGR calculation. A description of the problem discusses the practical application of the code to accommodate the geometric properties and the time, temperature and power related properties of a typical reactor. A listing of the sample problem input data and code output are included for reference. Author (NSA)

N69-34127# Los Alamos Scientific Lab., N. Mex.

RADIOGRAPHIC INSPECTION OF HOT REACTOR FUEL ASSEMBLIES USING THE 22-MeV BETATRON

D. E. Elliott and J. F. Torbert [1969] 23 p refs Presented at the Am. Nucl. Soc. 16th Conf. on Remote Systems Technol., Idaho Falls, Idaho, 11–13 Mar. 1969
(Contract W-7405-ENG-36)
(LA-DC-10050; CONF-690305-5) Avail: CFSTI

Radiographic techniques for the inspection of radioactive reactor fuel assemblies have been developed and applied over the past six years. The 22 MeV Allis–Chalmers Betatron was proven an excellent source for this radiography. It has the necessary small emitting surface, radiation output and radiation energy. This radiography has been valuable not only in providing information about the condition of the assembly but also as a guide for its subsequent destructive examination. The procedure produces better radiographic resolution than has been developed in neutron radiography but cannot be used on assemblies with as high gamma activity. Author (NSA)

N69-34148# Eidgenoessisches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).

DECONTAMINATION OF THE ROD CHANGE ZONE AND REMOVAL OF THE EXHAUST FILTER AFTER A URANIUM ROD FAILURE IN DIORIT [DEKONTAMINATION DER STABWECHSELFLASCHE UND BESEITIGUNG DER ABLUFTFILTER NACH EINEM URANSTABDEFEKT IM DIORIT]

F. Suter Jan. 1969 29 p refs In GERMAN
(EIR-148) Avail: AEC Depository Libraries

As a result of a cladding failure on a U rod, the rod change zone after the rod exchange, the air conditioning system between exchange surface and filter group, and the filter group itself were strongly contaminated. The course of the incident and the radiation conditions are described. The dismantling of the rod exchange area and the exchange of the exhaust filter are described. The personnel doses and the work and material expenditure during the decontamination operation are evaluated. NSA

N69-34165# Aktiebolaget Atomenergi, Stockholm (Sweden).

A NON-LINEAR DIGITAL COMPUTER MODEL REQUIRING SHORT COMPUTATION TIME FOR STUDIES CONCERNING THE HYDRODYNAMICS OF THE BWR

Frigyes Reisch and George Vayssier May 1969 35 p refs Submitted for publication
(AE-358) Avail: CFSTI

This non-linear model serves as one of the blocks in a series of codes to study the transient behaviour of BWR or PWR type reactors. This program is intended to be the hydrodynamic part of the BWR core representation or the hydrodynamic part of the PWR heat exchanger secondary side representation. The equations have been prepared for the CSMP digital simulation language. By using the most suitable integration routine available, the ratio of simulation time to real time is about one on an IBM 360/75 digital computer. Use of the slightly different language DSL/40 on an IBM 7044 computer takes about four times longer. The code has been tested against the Eindhoven loop with satisfactory agreement. Author (ESRO)

N69-34168# MSA Research Corp., Evans City, Pa.

DESCRIPTION OF MSAR LOOP 3 TEST FACILITY FOR HIGH-TEMPERATURE MECHANICAL PROPERTIES TEST PROGRAM IN SODIUM

L. H. Kirschler Mar. 1969 56 p refs
(Contract AT(11-1)-765)
(MSAR-69-45) Avail: CFSTI

Design criteria for loops which will lend support to loops 1 and 2 for the investigation of the mechanical properties of structural materials for the LMFBR are presented. The loop is capable of providing a maximum test temperature of 1400°F, maximum Na velocity of 30 ft/sec across the specimen gage length, maintaining a maximum Na purity of <5 ppM O_2, testing at various durations and initiating individual tests without affecting the remainder of the tests or the sodium chemistry of the system. Ten units are available for creep-rupture tests. The units have a volumetric flow rate of 8 gpm/unit. This flow rate and a 5 gpm rate from the bypass circuit and oxide control and indicating system (OCI) set the system flow rate of ~85 gpm. The heat source and the heat sink were sized from the flow rate. The Na containment material for high temperature Na is 316 stainless steel. Carbon steel and 18-8 stainless steel were used for Na containment at room temperature. Author (NSA)

N69-34170# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SURVEY OF CONTROL ROD DRIVE MECHANISMS FOR APPLICATION TO THE FFTF
J. C. Moakes and P. K. Telford Feb. 1969 90 p refs
(Contract AT(45-1)-1830)
(BNWL-973) Avail: CFSTI

A state-of-technology survey was completed on candidate control rod drive mechanisms (CRDM) for the Fast Test Reactor (FTR). Drive mechanisms reviewed include proven designs used in liquid metal cooled reactor systems, designs developed and tested for Na cooled reactor systems, proven designs used in water cooled thermal reactor systems, and conceptual designs emphasizing basic simplicity. Even though each of these control rod drive mechanisms was designed for a specific set of requirements, it is concluded that the CRDM concepts surveyed provide a valid basis for selection of specific concepts to be designed and developed to provide safe and efficient nuclear control of the FTR. 67 references.
Author (NSA)

N69-34179# California Univ., Livermore. Lawrence Radiation Lab.
COILS FOR THE SUPERCONDUCTING LEVITRON
Clyde E. Taylor and Thomas J. Duffy 9 Apr. 1969 18 p refs
Presented at the Symp. on Eng. Probl. of Fusion Res., Los Alamos, N. Mex.
(UCRL-71535; CONF-690407-18) Avail: CFSTI

The superconducting Levitron system now under construction consists of an 80-cm-diam, 600-kA, superconducting levitated ring wound with Nb_3Sn tape conductor; six stationary superconducting coils wound with Nb-Ti wire; and an array of stabilizing control coils, also superconducting, wound with multi-core Nb-Ti material designed for low ac loss. The coil system is described in detail. Tests were made on several inductively energized Nb_3Sn coils to determine critical temperatures. These tests are described.
Author (NSA)

N69-34180# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
FABRICATION OF OXIDE NUCLEAR FUEL PELLETS
Malcolm R. Harvey, Alton R. Teter, and Ronald L. Leggett 21 Mar. 1969 42 p refs
(Contract AT(29-1)-1106)
(REP-1255) Avail: CFSTI

A small number of uranium dioxide and mixed uranium–plutonium dioxide fuel pellets were fabricated by the cold press and sinter technique. The diametral variations observed were less than ± 0.003 in. based on a nominal diameter of 0.345 in. The average hourglassing was 0.003 in. for a length to diameter ratio of 1.5. It was concluded from this data and a literature survey that these variations could be maintained on a production basis and thus eliminate centerless grinding from the fabrication process.
Author (NSA)

N69-34227# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
PRESSURIZED WATER REACTOR PH-REACTIVITY EFFECT Final Report
J. O. Cermak, R. W. Columbo, W. D. Fletcher, F. L. Langford, Jr., A. G. Opitz et al Oct. 1968 162 p refs
(Contract AT(30-1)-3696)
(WCAP-3696-8; EURAEC-2074) Avail: CFSTI

An experimental program was performed to develop an understanding of the pH-reactivity effect observed in the operation of several closed-cycle water reactors. Reactor tests were conducted in the Yankee, Saxton, and ENEL (Trino, Italy) reactors to quantify the effect of coolant pH changes on reactivity under plant operating conditions, and to explore variables which could be identified through power level transients such as power swings and reactor trips. In-pile experiments were performed with an instrumented fuel assembly and a reactivity oscillator to provide more detailed data and better controlled test conditions than were obtainable from overall plant tests. Out-of-pile laboratory studies were performed to determine the effect of coolant chemistry under conditions which could not be effectively instrumented or controlled during in-pile operation.
Author (NSA)

N69-34238# Central Electricity Generating Board, Bristol (England). Berkeley Nuclear Labs.
THE PREPARATION OF OXIDATION RESISTANT COATINGS FOR URANIUM. PART 4. INTERDIFFUSION IN THE SYSTEM U-AL/MG-MAGNOX
R. J. Pearce and D. J. Bull Feb. 1969 26 p refs
(RD/B/N-1233) Avail: CFSTI

Studies of interdiffusion in the systems U-Al-Magnox and U-AlMg alloy-Magnox are described, and the feasibility of using these systems for preparing bonded and oxidation resistant coated fuel elements is discussed. The factors limiting this application are shown to be the problems of obtaining an adequately thick UAl_x layer to provide oxidation resistance and of not allowing the Al content in any residual Al-Mg alloy to exceed ≈1 wt %. The data show that both of these conditions may be fulfilled by using a 9% Al-Mg alloy with a heat treatment time of ≈90 h at 510°C. From current reactor experience this approach appears economically unattractive.
Author (NSA)

N69-34282# Oak Ridge National Lab., Tenn.
MESPRO 64: THE OPERATING SYSTEM FOR THE INTEGRATED COMPUTER INSTALLATION MIDAS
G. Krueger and G. Zipf [1968] 59 p refs Transl. into ENGLISH from German Rept. KFK-371
(ORNL-tr-1131; KFK-371) Avail: CFSTI

The MIDAS data acquisition and processing system for the FR-2 reactor is described. The principles of the MESPRO 64 program construction are presented. The time schedules and program sequences are discussed.
NSA

N69-34284# Gulf General Atomic, San Diego, Calif.
NEUTRON KINETICS IN SUBCRITICAL AND NONMULTIPLYING SYSTEMS
P. d'Oultremont 4 Jun. 1968 43 p refs
(Contract AT(04-3)-167)
(GA-8716; EURAEC-2079) Avail: CFSTI

An iterative solution to the diffusion approximation of the steady-state Boltzmann equation for reactor kinetics is given. The Fredholm integral of the second kind is transformed to the Fredholm integral of the first kind by assuming an expansion in the neutron flux. This transformation, then, leads to a definition of thermal equilibrium for the neutron population. Time-energy calculations for three fast subcritical assemblies are described; results of calculations are shown graphically. Time analyses for two thermal systems are detailed; data are included. The CAGE FORTRAN-4 program, used for the numerical calculations, is described.
NSA

N69-34322# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plant Div.
THE PROGRAMME FOR OPTIMIZATION OF THE BIOLOGICAL SHIELDS OF THE REACTORS
K. Vlachovsky Dec. 1968 11 p
(ZJE-30) Avail: AEC Depository Libraries

An algorithm for determining an optimum variant of a shielding is demonstrated. Use of this program confirmed the possibility of

optimization in a relatively shorter time than by use of the program calculating the neutron fluxes and averaged quantities, when applying data of each variant separately. Results show that multilayer shielding is better than shielding containing two or three layers, however, the differences are not large. Author (NSA)

N69-34323# Los Alamos Scientific Lab., N. Mex.
NEUTRON INTERROGATION AND DELAYED NEUTRON ASSAY OF FISSIONABLE MATERIAL SCRAP
M. M. Thorpe, C. N. Henry, and Darryl B. Smith [1968] 6 p Presented at Intern. Conf. on the Constructive Uses of Atomic Energy, Washington, D.C.
(Contract W-7405-eng-36)
(LA-DC-9757; CONF-681101-28) Avail: CFSTI

The delayed neutron leakage from a simulated 55-gallon scrap barrel was calculated using the LASL one-dimensional DTF-IV transport code. If large amounts of hydrogenous materials are present, the greatly enhanced delayed neutron response may be reduced considerably by normalizing to a fission chamber monitor containing the fissile species of interest. NSA

N69-34327# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
PRAWDA: A FORTRAN PROGRAM FOR PYROMETRIC INTERPRETATION OF STEAM- AND GAS-COOLED REACTORS [PRAWDA: EIN FORTRAN-PROGRAMM ZUR WAERMETECHNISCHEN AUSLEGUNG DAMPF- UND GASGEKUEHLTER REAKTOREN]
K. Doetschmann, F. Hofmann, and D. Kirsch Aug. 1968 57 p refs In GERMAN
(KFK-725) Avail: AEC Depository Libraries

The calculational bases and assumptions for the PRAWDA program are given; the equations used in the program are listed. The following calculational capabilities are discussed: coolant channel geometry, enthalpy balances for individual sectors, and reactor heat transfer with turbulence. Flow diagrams, input/output format, and a sample program with subroutines are included. The program is written in FORTRAN for the IBM 7094. NSA

N69-34352# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FTR FUEL SUBASSEMBLY PROCESS DEVELOPMENT
H. G. Powers and M. K. Millhollen 9 Jul. 1968 4 p refs Presented at the Intern. Conf. on the Constructive Uses of Atomic Energy, Washington
(Contract AT(45-1)-1830)
(BNWL-SA-1962; CONF-681101-26) Avail: CFSTI

Major factors to be considered in the selection of unit processes and control techniques for fabricating FTR fuel subassemblies (excluding fuel pins) are reviewed. A fabrication process for the reference design FTR subassembly is described and process experience gained in fabricating full scale subassemblies for hydraulic testing in flowing Na and water are discussed. A shielding concept for protection of assembly personnel was devised based on calculations and process requirements. NSA

N69-34353# Brookhaven National Lab., Upton, N.Y.
STAINLESS STEEL PRIMARY PIPING FOR THE HIGH FLUX BEAM REACTOR
Robert Baldwin 1968 19 p refs Presented at the Winter Ann. Meeting of the ASME, New York Supported by the AEC
(BNL-12542; CONF-681209-I) Avail: CFSTI

Stainless steel piping is now being used more for a variety of process systems. In many ways the stainless steel piping for the High Flux Beam Reactor (HFBR) is typical of these piping systems. The HFBR stainless steel piping system is discussed with respect to design, materials, fabrication, inspection, testing, and modifications installed after operation of the system. Author (NSA)

N69-34362# Oak Ridge National Lab., Tenn.
GAS TRANSPORT IN MSRE MODERATOR GRAPHITE. 2. EFFECTS OF IMPREGNATION. 3. VARIATION OF FLOW PROPERTIES
R. B. Evans, III, J. L. Rutherford, and A. P. Malinauskas May 1969 56 p refs
(Contract W-7405-ENG-26)
(ORNL-4389) Avail: CFSTI

A detailed investigation of the gas transport characteristics of MSRE moderator graphite has been conducted. These studies demonstrate that the impregnation treatments which had been applied for purposes of permeability reduction yield a material which is nonhomogeneous with respect to gas transport. For the specimen on which the most extensive measurements had been made, the inhomogeneity imparted to the sample as a result of impregnation was such that the characteristic transport coefficients were found to increase approximately exponentially from the surface to the core of the graphite. All of the moderator graphite which was surveyed was sufficiently impermeable that gas transport at conditions of reactor operation could be approximated reasonably well by considering only the free-molecule or Knudsen mechanism, although the overall variation of the Knudsen transport coefficient was observed to be of the order of 10^3. Author (NSA)

N69-34383# Southern Nuclear Engineering, Inc., Dunedin, Fla.
INVESTIGATION OF THE USE OF AQUEOUS SOLUTIONS AS EMERGENCY COOLANTS Final Report
C. Rogers McCullough, Gilbert M. Brown, R. P. Hancock, and S. E. Turner 31 Mar. 1969 129 p refs
(Contract AT(40-1)-3749)
(SNE-50) Avail: CFSTI

The testing of aqueous solutions or coolants other than water for use in water-cooled reactor emergency core cooling systems is described. The properties and performances of 23 selected chemical additives are presented. Experimental apparatus is described. NSA

N69-34365# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Institut.
REACTIVITY INTEGRALS AND THEIR USE FOR THE SOLUTION OF CERTAIN PROBLEMS IN REACTOR PHYSICS [INTEGRALY REAKTIVNOSTI I IKH PRIMENIE DLYA RESHENIYA NEKOTORYKH ZADACH FIZIKI REAKTOROV]
E. A. Stumbur 1968 51 p refs In RUSSIAN
(FEI-142) Avail: AEC Depository Libraries

The work sets forth the concept of integrals involving reactivity, specific functionals of solutions to the Boltzmann kinetic equation, which are simply connected with the k_{∞} of an arbitrary geometry reactor. Invariant integral relations are established for the Boltzmann equation in the case of critical and noncritical systems. The method of compensated perturbations, which results in a variation equation for the integrals involving reactivity is introduced. The developed theory is used to solve some problems in reactor physics having to do with the interdependence of the critical size and composition of a reactor or the reflector size, etc. Some contrasts of theoretical results and experimental data are discussed. The work considers further possibilities for developing the methods here set forth in order to solve other problems in reactor physics. Author (NSA)

N69-34368# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

A DESIGN PLAN FOR INVESTIGATING THE ATMOSPHERIC ENVIRONMENT ASSOCIATED WITH HIGH ALTITUDE NUCLEAR TESTING

Robert Olsen Mar. 1969 40 p refs

(AD-688512; ECOM-5244) Avail: CFSTI CSCL 18/3

An experimental concept is described for investigating and measuring a number of effects in an atmospheric environment associated with high-altitude nuclear testing. Specifically, these effects include atmospheric temperature and pressure before and after detonation, thermal radiation, overpressure, shock wave radius time determination, and determination or approximation of the blast wind velocity caused by a nuclear explosion. The ground equipment and payload which have been test-certified for performance are described, and actual test flight certification performance results are summarized. Improvements in overall system capability and reliability of the payload design are described. Author (TAB)

N69-34375# Centro Informazioni Studi Esperienze, Milan (Italy).

DEVELOPMENT PROGRAM ON THE APPLICATION OF STEAM-WATER SPRAY TO REACTOR COOLING. IN-PILE EXPERIMENTS ON STEAM-WATER MIXTURES: WATER CHEMISTRY

C. Cerrai, F. Gadda, C. Ronchetti, and A. Scaroni Dec. 1968 80 p refs /*ts* Topical Rept. No. 8

(Contract EURATOM-056-62-1-RDI)

(CISE-R-175; EURAEC-2090; EUR-4010) Avail: CFSTI

Experiments in the field of water chemistry of steam-water mixtures for use as coolants for the CIRENE reactor concept are reported. Two aspects were considered: formation of radioactive corrosion products; and production of radiolytic gases. Emphasis was on the effect on radiolytic gas production of parameters such as the presence of organic matter, the values of pH and conductivity the concentration of H_2 and O_2, and the thermohydraulic conditions of the steam-water mixtures. The experiments were performed with a specially designed and built loop located on the Avogadro 1 pool reactor. Author (NSA)

N69-34391# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.

PARAMETRIC EVALUATION OF THE INFLUENCE OF SUP 239 Pu AND FISSION PRODUCT CAPTURE CROSS SECTIONS ON LMFBR PERFORMANCE

J. E. Stewart Mar. 1969 69 p refs

(Contract AT(30-1)-3867)

(BAW-3867-7) Avail: CFSTI

Effects of large uncertainties on the ^{239}Pu capture cross section, over the entire spectrum, on the depletion and fuel management characteristics in an LMFBR core are evaluated. Two zone spherical cores with volumes of 2000 and 8000 liters are considered. Results of depletion calculations, from startup to equilibrium, are given for a two-batch core refueling scheme. Cross section variation effects are tabulated for: breeding ratios, mass balances, enrichments, power peaking factors, and discharge plutonium isotopic mixes. Isotopic worths for fuel, fission products and sodium, and Doppler coefficients were compared for the equilibrium cycle. NSA

N69-34397# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.

THERMAL NEUTRON FIELD PULSING. TEMPERATURE OF COOLANT CHANNEL WALLS AND WATER LEVEL OF SEPARATE VERTICAL CHAMBER DURING BOILING IN ACTIVE ZONE OF WWR-S REACTOR

R. Dzhordzhescu and K. Dobrescu 1968 25 p refs In RUMANIAN

(IFA-TR-56) Avail: AEC Depository Libraries

Analysis of the pulsations of the various parameters is a sensitive method for identifying the processes involved in boiling. In view of the fact that earlier studies considered only the pulsation of the thermal neutron field, caused by changes in the moderator, experiments were carried out to examine the importance of other factors. The experimental chamber was placed in the core of the WWR-S reactor, replacing one of the fuel-element assemblies. The reactor was operated at a constant power level of 5 kW during the experiment. Pulsations of the thermal-neutron field measured by means of an ionization chamber placed 200 mm from the edge of the core, studying them by a frequency analyzer within the 0.1 to 40 Hz range. The chamber consisted of an A1 pipe, heated by a tube to which a Nichrome wire was attached. The temperature of the pipe wall, heater wall and the water at various heights was measured by Cu-constantan thermocouples with an error of less than 0.25°C; a float attached to a potentiometer was used to determine the water level. NSA

N69-34399# Kernforschungszentrum, Karlsruhe (West Germany). Inst. Fuer Reaktorentwicklung.

LIQUID METAL BOILING RESEARCH

W. Peppler and G. F. Schultheiss Oct. 1968 30 p refs

(KFK-874; EURFNR-626; EUR-4157.e) Avail: AEC Depository Libraries

Experimental investigations of boiling phenomena for liquid metals carried out at Karlsruhe in a program to examine sodium-cooled fast reactor safety aspects are presented. Preliminary results of experiments on the influence of cavities and oxide concentration on sodium superheat and on boiling and recondensation phenomena in a large sodium loop are reported. NSA

N69-34401# General Electric Co., Sunnyvale, Calif. Advanced Products Operation.

AN IN-PILE EVALUATION OF W-Re THERMOCOUPLE SYSTEMS FOR USE TO 4700 DEG F IN SEFOR FUEL

P. E. Novak and R. R. Asamoto Oct. 1968 86 p refs

(Contract AT(04-3)-540)

(GEAP-5468) Avail: CFSTI

In-pile tests were conducted to develop reliable W-Re thermocouple systems capable of measuring fuel temperatures up to 4700°F in the Southwest Experimental Fast Oxide Reactor (SEFOR). Results showed that W5Re/W26Re thermocouples can be expected to decalibrate less than 45°F at 800°F and less than 10°F at 3000°F after their full design life of 1800 hours in the SEFOR core. Both BeO and ThO_2 insulated thermocouples operated satisfactorily for over 1200 hours in-pile at temperatures in excess of 4200°F. BeO will be used as thermocouple insulation for the majority of the SEFOR fuel thermocouples while ThO_2 will be used in locations where fuel temperatures are expected to exceed the melting point of the BeO. Bare wire, 1/16-inch (sheath diameter) W26Re sheathed thermocouples, and 1/8-inch (sheath diameter) W26Re sheathed thermocouples operated satisfactorily in-pile under both steady state and transient conditions which are representative of those expected in SEFOR. Author (NSA)

N69-34412# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.

CALCULATION OF BUILD-UP AND RELEASE RATES OF VARIOUS NUCLIDES FROM A UO SUB 2 FUEL ELEMENT

G. Cenacchi and G. J. Segre 1968 23 p refs Transl. into ENGLISH from Comitato Nazl. Energia Nucl. Report RT/FIMA-(67)2 (AERE-TRANS-1109; RT/FIMA-(67)2) Avail: CFSTI; UK 3s 6d

Calculations are presented of the buildup and release rates of some nuclides which appeared to be the most deserving of study on the basis of chemical and physical considerations, in relation to fast reactor fuel elements. It is pointed out that the mathematical formulation of the problem leads to very complicated equations involving some unknown physical constants and some poorly known phenomena, such as the adsorption and absorption of gases on the oxide surface. A simplified model is used, employing hypotheses which are explained. NSA

N69-34419# Central Electricity Generating Board, Bristol (England). Berkeley Nuclear Labs.
THE OPTIMISATION OF AXIAL RATING SHAPES (IN AGR'S)
D. V. Frock and A. A. Stratton Mar. 1969 27 p refs
(RD/B/N-1328) Avail: CFSTI

By considering only thermal factors, ideal axial rating shapes to give maximum channel power or minimum channel length are derived. These act as standards against which the thermal performance of actual shapes may be judged. Numerical methods of calculating the channel power or channel length for any shape are given. A method for improving the thermal performance of a channel by altering the axial shape in stages is described. This may be used when adjusting enrichments axially. The analysis is in terms of nominal temperatures, but the extension of systematics is also formulated. NSA

N69-34430# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Development Center.
GEL-ADDITION PROCESS CHEMICAL STUDIES Quarterly Progress Report, 1 Aug.–31 Oct. 1968
E. H. Dewell Jan. 1969 35 p refs
(Contract AT(30-1)-3714
(BAW-3714-9; QPR-9) Avail: CFSTI

The development of the sol-gel process and related processes for preparing $(U,Pu)O_2$ fast reactor fuels was continued. Preparation of $(U\text{-}20Pu)O_2$ sol-gel spherical fuel in two size ranges for thermal reactor testing is complete. Two uranium enrichments, natural UO_2 and 20% enriched $^{235}UO_2$ were used to obtain material that will give two different in-pile heat rates at the same elemental compositions. The first irradiation capsule test is complete. The heat rate was 16.7 kW/ft, and the capsule received 9.3 EFPD. The capsule is the first of a series designed to show differences in restructuring kinetics between pellets and vibratory compacted spheres and shards. Equipment was installed for measuring particle crush strengths, water vapor contents, and oxygen-to-metal ratios in fuels. UO_2 gel and oxide spheres were examined on the B and W scanning electron microscope. Author (NSA)

N69-34442# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
OXIDE FUEL ELEMENT DEVELOPMENT Quarterly Progress Report, Period Ending 31 Dec. 1968
A. Biancheria, A. A. Bishop, A. Boltax, W. E. Ray, and B. Riley Feb. 1969 55 p refs
(Contract AT(30-1)-3791)
(WARD-3791-32) Avail: CFSTI

Analysis of stainless steel cladding swelling data was continued and the effects of cladding failure on fuel behavior were examined. Discrepancies in data on the creep strength of 316 stainless steel were investigated and minor variation in composition or mechanical or thermal treatment were found to cause significant variations in mechanical properties and microstructure. Preliminary design studies were conducted on the conceptual design of a fuel pin with fixed spacers compartmenting the fuel column, the spacers are used to provide more reproducible fuel expansion. Type 316 stainless steel dimpled grids were used in a 37-pin assembly. NSA

N69-34444# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
COOLANT MIXING AND ITS EFFECT ON THE HOT-CHANNEL TEMPERATURE IN A STEAM-COOLED REACTOR [KUEHLMITTEL-QUERVERMISCHUNG UND DEREN AUSWIRKUNG AUF DIE HEISSKANAL-TEMPERATUREN IN DAMPFGEKUEHLTEN SCHNELLEN REAKTOREN]
K. Doetschmann Oct. 1968 24 p In GERMAN
(KFK-848; EUR-4151) Avail: AEC Depository Libraries

Methods for determining the cross mixing of the coolant in a steam cooled reactor are described. Consequences of cross mixing on the hot-channel temperatures are analyzed. Hot channel factors, with and without cross mixing, are tabulated. Axial temperature distributions for coolant and cladding temperatures are shown as a function of core radius. NSA

N69-34480# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
VANADIUM ALLOY CLADDING DEVELOPMENT Quarterly Progress Report, Period Ending 31 Dec. 1968
E. C. Bishop, R. A. Nadler, and G. A. Whitlow Feb. 1969 68 p refs
(Contract AT(30-1)-3791)
(WARD-3791-30) Avail: CFSTI

In the development of vanadium alloys for fuel cladding for service in a liquid-metal-cooled fast breeder reactor, the nuclear and economic analysis of vanadium fuel element cladding was completed, as was all melting, extrusion and tube reduction. Processing to rod and sheet was accomplished for all alloys except for 15 Cr–5 Ti–V-base alloy. Creep rupture tests at 800°C on the VANSTAR alloys were continued along with tests of vacuum effects on creep. The effects of 500-hour aging at 700 and 800°C on the hardness, mechanical properties and microstructure of VANSTAR alloys were small but some precipitation was observed. The sodium corrosion loops ran satisfactorily, the higher velocity system completed operation after 1500 hr. The corrected oxygen analysis of both systems is now >10 ppM. Unalloyed V wires were exposed in both loops for internal friction evaluation of the loop impurities. Activation energies for VANSTAR-7, VANSTAR-9 and 20-Ti-V were calculated. Chemical analyses of corroded VANSTAR-9 revealed large quantities of C, N, and O interstitials absorbed during corrosion resulted in weight gains, and reduction in the mechanical properties. NSA

N69-34484# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plant Div.
USE OF CALORIMETRIC SOUNDS IN IN-PILE TECHNIQUE
Josef Kott Jul. 1968 15 p refs
(ZJE-28) Avail: AEC Depository Libraries

The development of calorimeters in Czechoslovakia for in-core dosimetry of neutrons and gamma radiation is discussed. Author (NSA)

N69-34486# Ceskoslovenska Akademie Ved, Rez. Ustav Jademeho Vyzkumu.
CORRELATION OF THE FPV-3 PROGRAM AND PROBLEMS OF BURN UP IN REACTOR A2
B. Kujal Feb. 1969 17 p refs In CZECHOSLOVAKIAN
(UJV-2140-R) Avail: AEC Depository Libraries

The adjustment of the FPV-3 code for fuel burnup calculations in heavy water reactors is presented. For FPV-3 code fitting, the data derived from the operation experience of NPD and and Ägesta reactors were used. The results of FPV-3 code adjustment were used for fuel burnup calculations in the A2 reactor. Author (NSA)

N69-34480# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
URANIUM PLUTONIUM CARBIDE DEVELOPMENT Quarterly Progress Report, Period Ending 31 Dec. 1968
A. Biancheria and W. R. Jacoby Jan. 1969 69 p refs
(Contract AT(30-1)-3791)
(WARD-3791-31) Avail: CFSTI

A statistically designed experimental program was run to determine the major effects of process variables on stoichiometric and hyperstoichiometric fuel. The effects of varying binders, milling time, sieve size, purge gas flow rate, and sintering temperature use rate were studied. Carbon contents of 4.45 and 4.75 wt% were used for the stoichiometric and hyperstoichiometric compositions, respectively. Fabrication of EBR-II Phase I fuel pellets continued. As high tungsten values were noted in batches of pellets fabricated previously, steps were initiated, to identify the contamination sources and to minimize the problem. A physical inventory of the characterization line and vault was conducted. In addition, many scrap batches were oxidized, combined whenever possible into larger batches, and then sampled for Pu and U contents. Routine analytical chemistry and metallographic analyses of potential EBR-II Phase I fuel continued. Author (NSA)

N69-34487# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
A FORTRAN PROGRAM FOR CALCULATING THE THERMODYNAMIC CYCLE PROCESS AND THE COOLING CIRCUIT OF STEAM-COOLED NUCLEAR REACTORS
H. Spilker [1968] 115 p refs Transl. into ENGLISH from the German report KFK-716
(EURFNR-597; KFK-716) Avail: CFSTI

A digital computer program MAINPROG is described. The program calculates the thermodynamic cycle process and cooling circuit for superheating reactors. The program is written in FORTRAN for the IBM 7040. NSA

N69-34506# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plant Div.
IRRADIATION EFFECTS IN REACTOR PRESSURE VESSEL STEELS AND ELECTROSLAG WELDING JOINTS
Milan Brumovsky Jun. 1969 22 p
(ZJE-55) Avail: AEC Depository Libraries

Information about changes of basic mechanical properties of pressure vessel steels, caused by neutron irradiation is presented on materials such as steel CSN 13030 (Ni, Al + Ti) and its electroslag welds, steel 13030 (MnNiMoNb) – type A 302 B steel – and its electroslag weld, and 1.5 Ni, 0.5 Cr, 0.5 Mo type steel, developed for reactor pressure vessels. Author (NSA)

N69-34507# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
DESIGN AND OPERATION OF AN INSTRUMENTED FUEL SYSTEM. HIGH POWER DENSITY DEVELOPMENT PROJECT
A. C. Duckart Jun. 1968 82 p refs
(Contract AT(04-3)-381)
(GEAP-4750) Avail: CFSTI

The design, development, and operations history of the instrumented fuel assemblies for boiling water reactors, particularly Vallecitos and Big Rock Point, are detailed. An instrumented assembly consists of devices to measure channel inlet and outlet volumetric flow rate, coolant temperatures, and local thermal neutron fluxes. Design specifications are tabulated for the turbine flowmeter, variable reluctance pressure differential transducer, chromel-alumel thermocouple, and fission chambers; readout systems are specified also. The instrumented fuel controls for Vallecitos are shown schematically. Operations histories of instrumented fuel assembly components are summarized; failures and causes of failures are described. Design drawings of the Big Rock Point instrumented fuel assembly are included; the complete experiment rig is described. The operations history is detailed; failures are described. Instrument redesign, calibration, and testing are detailed; results are included. NSA

N69-34513# Oak Ridge National Lab., Tenn.
THERMODYNAMIC APPLICATIONS TO U-Pu OXIDE FUEL SYSTEMS
K. E. Spear, A. R. Olsen, and J. M. Leitnaker Apr. 1969 18 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2494) Avail: CFSTI

Thermodynamic information was used to describe equilibrium chemical interactions of $(U,Pu)O_{2\pm x}$ fuels with cladding and bonding materials in a fast reactor environment. The model describes the limiting behavior of a fuel system. Previous data are reviewed. Author (NEA)

N69-34517# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Mar. 1969
(Contract W-31-109-eng-38)
(ANL-7561) Avail: CFSTI

Highlights of project activities are summarized for the month of March 1969. Fuel and components development programs for the LMFBR are described. Operations for the ZPR-3 and ZPPR during February are described. Research and development programs in the EBR-2 are reviewed. Nuclear safety studies, including TREAT operations, and chemical separation activities are discussed. NSA

N69-34583# Argonne National Lab., Ill. Reactor Physics Div.
TIME-OPTIMAL DIGITAL CONTROL OF ZERO-POWER NUCLEAR REACTORS
Thomas J. Marciniak (Ph.D. Thesis – Notre Dame Univ.) Oct. 1968 115 p refs
(Contract W-7405-eng-38)
(ANL-7510) Avail: CFSTI

The program is required to increase power level while maintaining a minimum allowed period, and to reach the demand power level with little, or no, overshoot. To design a stable, time-optimal control system effectively, the stability in the small of a specific error-sampled digital control system was determined for various data holds and sampling intervals for typical fast and thermal reactors. It was found that the zero-order hold was the most stable in most cases for sampling intervals ranging from 0.1 to 5.0 sec. A time-optimal study using the discrete maximum principle was made, with especial emphasis on the terminal control of a one-delayed-group reactor. The control program was applied, in digital simulation, to noise-free reactor models with a linear control rod, nonlinear control rod, and to a noisy reactor with a non linear control rod. Performance is analyzed. The program was modified for use with ATSR using a DDP-24 computer. Results are presented. Author (NEA)

N69-34584# Gulf General Atomic, San Diego, Calif.
COMPILATION OF TECHNICAL EVALUATIONS RELATED TO ON-LINE REFUELING MACHINE STUDY "A"
30 Jun. 1968 69 p refs
(Contract AT(04-3)-167)
(GA-8639) Avail: CFSTI

The shielding calculations and requirements for an on-line A refueling machine for a 1000 MW(e) high-temperature gas-cooled reactor are presented. The economics for such a loading machine are analyzed. NSA

N69-34565# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plant Div.

CONTRIBUTION TO THE PROBLEMACY OF TEMPERATURE SHOCKS IN GAS-COOLED REACTORS

Jiri Gregor and Jan Martinek Sep. 1968 26 p refs

(ZJE-43) Avail: AEC Depository Libraries

One of the serious problems encountered when designing and constructing gas-cooled nuclear reactors is temperature shocks that have detrimental effects on the primary pipeline. Theoretical and experimental coordinated research of the pipeline, both as to the stress of material and to the production technology, is described. Under conditions of operation at the temperature of about 430°C, the hot pipeline of the primary gas circuit of the A-1 nuclear power plant is exposed to the effects of the inner gas pressure of about 55 kp/cm^2. A reactor shutdown, a sudden temperature fall of the cooling gas to about 120°C occurs at the reactor outlet. This temperature fall induces considerable temperature stress in the pipeline walls. Author (NSA)

N69-34569# Bettis Atomic Power Lab., Pittsburgh, Pa.

CRITICAL HEAT FLUX TESTS ON A COOLANT CHANNEL SIMULATING A CLOSELY SPACED LATTICE OF RODS

S. J. Green, B. W. Le Tourneau, E. F. Saladna, and P. S. Sherba Mar. 1969 15 p refs

(Contract AT(11-1)-GEN-14)

(WAPD-TM-466) Avail: CFSTI

Critical Heat Flux tests were conducted with vertical upflow of water at 1200 to 2000 psia on a uniformly heated 48-inch long channel that simulated a typical reactor coolant flow channel within a bundle of closely spaced rods. Two rod-to-rod spacings were simulated, 0.030 and 0.015 inch. The test results indicate that there was no adverse thermal effect produced by these relatively close spacings. The measured critical heat fluxes were in agreement with data previously obtained with rectangular channels having channel spacings of 0.050 and 0.097 inch indicating a negligible effect of channel spacing over the range 0.015 to 0.097 inch. Author (NSA)

N69-34570# European Co. for the Chemical Processing of Irradiated Fuels, Mol (Belgium).

NEW METHOD FOR THE ALPHA ACTIVITY SPECIFICATION ANALYSIS OF URANIUM FINAL PRODUCTS

H. Eschrich and I. Hundere Apr. 1968 31 p refs

(NP-17816; ETR-226) Avail: AEC Depository Libraries

An analytical method permitting the simultaneous separation of neptunium and plutonium as well as the separation of transplutonium elements from uranium in a single procedure is described. Uranium final product samples are treated to obtain a uranyl nitrate solution that is 3M in nitric acid. The neptunium and plutonium are oxidized to the hexavalent oxidation state with argentic oxide. An aliquot of the adjusted sample solution containing 200 to 400 mg uranium is introduced into an extraction chromatographic column in which purified tributyl phosphate sorbed on poly(trifluoromonochloroethylene) (Voltalef 300 Micro PL) particles forms the stationary phase. The effluent fraction containing the neptunium and plutonium is used to determine the alpha disintegrations per minute per gram of uranium. The problem of the simultaneous separation of neptunium and plutonium from uranium is outlined and the application of phenylhydrazine as reducing agent by Purex type processes is briefly discussed. Author (NSA)

N69-34578# General Electric Co., Sunnyvale, Calif. Advanced Products Operation.

SEFOR FUEL ASSEMBLY SODIUM FLOW TESTS

J. T. Cochran Sep. 1968 67 p refs

(Contract AT(04-3)-540)

(GEAP-5466) Avail: CFSTI

Calibration data and curves for the flowmeters of the Southwest Experimental Fast Oxide Reactor instrumented fuel assembly are recorded. Sodium coolant loops, their disassembly, and the failure of the Barton differential pressure measuring system in the operation of sodium coolant loops are analyzed. Pressure drop as a function in sodium coolant loops and its value is also considered. NSA

N69-34579# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY Quarterly Progress Report, Jul.–Sept. 1968

Dec. 1968 157 p refs

(Contract AT(04-3)-189)

(GEAP-5716; QPR-14) Avail: CFSTI

Crack growth and the effects of temperature and stress on low-cycle fatigue carbon steels, chromium alloys, molybdenum alloys, and stainless and other steels is investigated. A computer program for stress analysis in metal was performed. Equations for through-wall low-cycle fatigue of pipes composed of these materials and which are components of reactor primary coolant systems are also included. NSA

N69-34580# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY Quarterly Progress Report, Apr.–Jun. 1968

Aug. 1968 90 p refs

(Contract AT(04-3)-189)

(GEAP-5680; QPR-13) Avail:

Fatigue testing and the effects of temperature and stress on carbon steels, chromium steels and systems, molybdenum steels and systems, and stainless-type steels is reported. The materials are constituents of reactor primary coolant system pipes. Crack growth, effects of flow configurations, and the tensile properties of these materials are also investigated. NSA

N69-34581# General Electric Co., Sunnyvale, Calif. Advanced Products Operation.

SEFOR INSTRUMENTED FUEL ASSEMBLY DESIGN AND DEVELOPMENT

E. R. Craig Apr. 1968 61 p refs

(Contract AT(04-3)-540)

(GEAP-5615) Avail: CFSTI

Design criteria and drawings of components of the Southwest Experimental Fast Oxide Reactor instrumented fuel assembly are recorded. These components include magnetic flowmeters, instrumentation specifications, thermocouples, and remote handling equipment. A description of the on-line data acquisition systems is also produced. NSA

N69-34586# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FFTF INERT GAS SELECTION STUDY

R. V. Dulin and C. J. Foley 13 Nov. 1968 52 p Presented at Remote Handling and Exam. in the Fast Reactor Field Meeting, Idaho Falls, Idaho, 11–13 Mar. 1969

(Contract AT(45-1)-1830)

(BNWL-SA-2215; CONF-690305-3) Avail: CFSTI

Conceptual design of the FFTF includes a range of applications which will require inert gas as a cover gas for liquid metal systems or as an atmosphere in areas where Na-bearing surfaces are exposed to that atmosphere or as a protective atmosphere in enclosures for systems containing radioactive Na. Due to the wide range of applications and their diverse requirements, considerable conceptual study effort was required to select the appropriate gas or gases for each application. The elements of a gas selection study performed in support of conceptual design of the FFTF inert gas systems are presented. Author (NSA)

N69-34590# Oak Ridge National Lab., Tenn.
SURVEY OF NUCLEAR REACTOR SYSTEM PRIMARY CIRCUIT HEAT EXCHANGERS
H. A. Nelms and C. L. Segaser Apr. 1969 90 p refs
(Contract W-7405-eng-26)
(ORNL-4399) Avail: CFSTI

Problems resulting from excessive tube vibration in certain primary-circuit heat exchangers in reactor systems were evaluated. Of the 19 reactor systems surveyed, problems in primary exchangers resulting from tube vibration hydrodynamically induced by the shell-side fluid flow were experienced in 9 of the 17 plants that have been operated. The results of a detailed vibration analysis that was based on well-known procedures and information available in the literature supports the general conclusion that if the designs for these exchangers had been critically examined for tube vibration prior to fabrication, and possibility of failure would have been judged too great to accept and the problems could have been averted by design modifications. Author (NSA)

N69-34600# Institute of Nuclear Research, Warsaw (Poland).
BETATRON 30 MeV
J. Janiczek and R. Kielsznia 1969 15 p In POLISH; ENGLISH summary
(INR-958) Avail: AEC Depository Libraries

In this paper, the 30-MeV betatron in operation at the Institute of Nuclear Research is described. Technical and operating data as well as descriptions of the major subsystems and components are given. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-33297*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PERCEIVED SOUND
Jess H. Jones *In its* Res. Achievements Rev., Vol. 3 1968 p 71-80 refs (See N69-33289 19-31)
Avail: CFSTI CSCL 20A

The human auditory system is represented as a simple input/output system. When presented in this manner, the magnitude of an auditory sensation, or more specifically, the perceived sound can be obtained by multiplying the input acoustic stimulus by the square of the complex frequency response function of the human auditory system. The results obtained through the use of this simple model agreed with those of judgment tests as well as presently accepted methods. Author

N69-33300*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTICAL CROSS-BEAM INVESTIGATION OF LOCAL SOUND GENERATION IN JETS
F. R. Krause *In its* Res. Achievements Rev., Vol. 3 1968 p 99-110 refs (See N69-33289 19-31)
Avail: CFSTI CSCL 20M

Optical cross-correlation techniques were developed to provide many of the experimental inputs which semi-empirical models need for prediction of noise generation at the source. The location of sound source intensities in jet shear layers requires area integrals of correlated density fluctuations. Two narrow light beams are set to detect sound sources in the flow by triangulation. A digital cross-correlation of the optical signals from the two beams is then used to approximate the desired area integration of correlated disturbances. This optical integration over correlation areas is confirmed experimentally by verifying the radial resolution and spectra that are expected for point area product mean values. The measurement of streamwise velocity variations in supersonic jets is required to apply present models of noise generation in turbulence-shock wave interaction zones. As a preliminary step, mean velocity profiles were measured in supersonic flows by using a statistical cross-correlation between streamwise separated and delayed beams. Author

N69-33313*# California Univ., Berkeley. Space Sciences Lab.
ADJUSTABLE MOUNT FOR A TRIHEDRAL MIRROR
Harry W. Petersen, inventor (to NASA) and Raymond O. Laurie, inventor (to NASA) Filed May 13, 1969 17 p Prepared for NASA
(NASA-Case-XNP-8907; US-Patent-Appl-SN-824042) Avail: CFSTI CSCL 20F

The mount consists of three contiguous mirror segments having adjustable reflecting surfaces arranged in mutually normal planes. A bottom plate is affixed to a pair of coupled and normally disposed side plates along a pair of intersecting edge portions. Each side plate supports a backup plate through threaded adjusting screws connected to several tension springs. The backup plates and the bottom plate are joined by extended and tensioned links of music wire to the edge surfaces of an adjacent mirror segment in a manner such as to preclude an interruption of impinging beams of light. Each of the mirror segments thus can be adjusted by manipulating the adjusting screws, while heat-induced error is rendered negligible. The reflecting surfaces may be adjusted to assume a fixed, mutually normal relationship with minimum deviation error. The mirror and the screws are made of Invar. The mount is particularly suited for use in interferometers. NASA

N69-33332*# Maryland Univ., College Park.
ON PROCESSING OPTICAL IMAGES PROPAGATED THROUGH THE ATMOSPHERE FROM OBJECTS WITH UNKNOWN MOTION PARAMETERS
Robert O. Harger *In* NASA. Evaluation of Motion-Degraded Images 1969 p 95-103 refs (See N69-33322 19-14)
Avail: SOD $2.00; CFSTI CSCL 20F

The problem of how to process the optical wavefronts received in a spatial and temporal aperture after scattering from an object of interest and after propagation through the turbulent atmosphere is considered here. It is assumed that: (1) the turbulence and geometry are such that the received signal wavefront is multiplied by a complex phase error that is a time-independent, homogeneous, and isotropic Gaussian field over the receiving aperture (conditions for which this approximation is valid being discussed); (2) thermal noise is received additively along with the distorted signal wavefront; (3) certain parameters of the object are to be measured and the maximum likelihood criterion is used; (4) the object has unknown motion parameters; (5) a relatively short-time-duration coherent illumination of the object is made; and (6) the complex

phase error has a correlation distance short relative to the aperture size. A model for the scattered wavefront from the moving object is given and the likelihood functional is derived. Optical systems useful in physically realizing the likelihood functional are briefly described. General expressions for the minimum error that can be achieved in estimating the object's desired unknown parameters–the Cramer–Rao lower bound–are derived and the effect of the object's unknown motion parameters discussed. A comparison is made with the turbulence-free and the unknown-motion free cases. Author

N69-33382# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France). Faculte des Sciences.

PROOF OF THE EXISTENCE OF SPONTANEOUS MAGNETIZATION IN THE ANISOTROPIC HEISENBERG FERROMAGNET

J. Ginibre May 1969 17 p refs

(Rept-69/37) Avail: CFSTI

It is proven that the aniaotropic Heisenberg ferromagnet in dimension $\nu \geq 2$ exhibits spontaneous longitudinal magnetization if the temperature is sufficiently low and the transverse part of the interaction sufficiently small. Author

N69-33486*# Techtran Corp., Glen Burnie, Md.

THERMAL CONTROL OF TRANSPARENT ELEMENTS ON BOARD ARTIFICIAL SATELLITES

C. Arduini Apr. 1968 12 p Transl. into ENGLISH from Aerospace Res. Center (Rome) conf. paper Presented at the 15th Intern. Electron and Nucl. Conf., Rome Apr. 1968 Submitted for publication

(Contract NAS5-14826)

(NASA-CR-101131) Avail: CFSTI CSCL 20F

Aboard artificial satellites there may be transparent elements (e.g. windows) in conditions effecting thermal exchange with the system behind them. Under these circumstances the optical characteristics of the transparent window affect the behavior of the system by being a contributing factor in the setting of the operating temperature. The purpose of this paper is to examine this effect in a window-substrate system. The analysis is arranged in such a manner as to express the above effects as changes of the natural optical characteristics (absorbency and emissivity) of the individual surfaces, so as to be able to lay out the thermal balance calculations in a manner that is identical in form with conventional cases. Author

N69-33552# Technische Hochschule Munchen (West Germany).

CALCULATION OF SOUND ABSORPTION IN SUPERFLUID HELIUM AT LOW TEMPERATURES [BERECHNUNG DER SCHALLABSORPTION IN SUPERFLUIDEM HELIUM BEI TIEFEN TEMPERATUREN]

Josef Jeackle (Ph.D. Thesis) 1969 78 p refs In GERMAN

Avail: CFSTI

By way of the phenomenological Boltzmann equation for phonons in helium 2 it is shown that parallel processes alone lead only to pure Landau damping. An extended relaxation time formulation that also takes parallel processes into account is found to reproduce a result cited by other investigators. Green functions are used to prove that the asymptotic law for the damping of high-frequency sound depends only on the existence of a linear phonon spectrum, not on the Lorentz form of the spectral function. The contribution of the fourth order of cubic anharmonicity to the self-energy leads to a qualitatively correct convergence of the absorption curve with the asymptote. Transl. by K.W.

N69-33653# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.

THE INDUCED TRANSFORMATION IN THE 5-DIMENSIONAL FIELD THEORY [DIE INDUZIERTE UBERTRAGUNG IN DER 5-DIMENSIONALEN FELDTHEORIE]

R. Burghardt 1969 7 p In GERMAN

(SGAE-PH-81/1969) Avail: CFSTI

A transformation is induced in a five-dimensional Riemaa space V_5 by parallel displacement of a vector into the embedded V_4. The transformation is asymmetric and contains the electromagnetic field strengths. The equation of motion for a charged particle in the gravitational and electromagnetic fields is derived from a uniform principle by means of the induced transformation. Transl. by K.W.

N69-33621# Eidgenossische Technische Hochschule, Zurich (Switzerland).

THE TEMPERATURE DEPENDENCE OF THE ELECTRONIC POLARIZATION POTENTIAL OF STRONTIUM AND BARIUM TITANATES [DIE TEMPERATURABHAENGIGKEIT DER ELEKTRONISCHEN POLARISERBARKEIT VON STRONTIUM- UND BARIUMTITANAT]

Robert Hofmann (Ph.D. Thesis) 1968 80 p refs In GERMAN *Its* Diss. No. 4009

Avail: CFSTI

The temperature dependence of the optical polarization potential was measured by interferometry and theoretically studied for its influence on the temperature behavior of the static pressure coefficient. In addition, the possible relationship between the measured temperature behavior of the refractive index and the predicted temperature dependence of a transversal-optical lattice vibration was to be determined. Interference was measured on a thick wedge. To optimize experimental conditions and measuring accuracy, the intensity distribution was numerically established for different optical thicknesses, surface reflectivities, and wedge angles. Changes in the optical thickness due to temperature were measured by determining the displacement of the interference pattern. The results the theoretically evaluated within the adiabatic approximation and based on the extrapolation to the infinite light wave length. The electronic fractions of the reciprocal Curie constant are examined and are found to be significant. The particle-in-cell model is analyzed for its ability to yield quantitatively correct results of optical effects in the extrapolation to the infinite wave length. Transl. by K.W.

N69-33640# Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research Div.

INTERACTION OF LIGHT WITH A PLANT CANOPY

William A. Allen and Arthur J. Richardson *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 219–232 refs (See N69-33626 19-14)

Avail: CFSTI

The Kubelka–Munk (K–M) theory was applied to light interaction with leaves stacked in a laboratory spectrophotometer. The theory can also be applied to an actual field plant canopy. The K-M theory is a two-parameter generalization of the one-parameter Bouguer–Lambert, or Beer's law, relation. The older theory accounts for transmittance of a medium but not for reflectance. The K-M theory, however, yields a theoretical value both for reflectance and transmittance. The K–M theory is applied in this paper to the reflectance and transmittance of stacked mature cotton leaves over the spectral range 0.6μ - 2.5μ. The standard deviation between theory and experiment, after known biases are calculated and removed from the data, is about one percent, a discrepancy well within experimental error. A procedure is developed to apply the K–M theory to an actual plant canopy. Author

N69-33843# Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research Div.
EFFECT OF PUBESCENCE ON REFLECTANCE OF LIGHT
Harold W.Gausman and Ruben Cardenas *In* Mich. Univ. Proc. of the 5th Symp. on Remote Sensing of Environment Sep. 1968 p 291–297 refs (See N69-33626 19-14)
Avail: CFSTI

Hairs were removed from ventral surfaces of young leaves of *Gynura aurantiaca* (velvet plant) with an electric razor. Pubescence significantly increased total and diffuse reflectance in the 750 to 1,000 mu region, but it decreased total and diffuse reflectance in the 1,000 to 2,500 mu region. Hairiness had little effect on the reflectance of visible light within 500 to 750 mu. Theoretically, hairs increased scattering of incident radiation and thereby increased total reflectance in the near-infrared region between 750 and 1,000 mu. This mechanism does not explain the reduced reflectance due to hairiness in the 1,000 to 2,500 mu region. Further research is needed to explain this phenomenon. Author

N69-33839# Aerospace Research Labs. Wright-Patterson AFB, Ohio.
THEORY OF ELECTRIC ARCS WITH RADIAL MASS INFLOW Final Report
Herbert Druxes Jan. 1969 169 p refs
(AD-687862; ARL-69-0008) Avail: CFSTI CSCL 20/9

In order to determine the applicability of a single-component approach to the problem of an arc with radial mass inflow, a detailed discussion of the basic electrodynamic and gasdynamic equations is presented. Appropriate comparisons among the nondimensionalized parameters allow one to make certain simplifications for low Mach numbers. The results indicate that specific dimensionless quantities appear which characterize the operating range for this type of arc. For a laminar, stable, rotationally-symmetric arc with uniform radial mass inflow, an exact numerical solution is made which is then compared with a particular model theory. This model theory assumes that the gas density and viscosity are known as functions of the radius and the boundary conditions at the tube wall. Good agreement is found between the numerical solution and the model theory. One also concludes that radial mass inflow can remarkably reduce the heat flux to the walls thus leading to higher axis temperature for the same electric power input. Author (TAB)

N69-33842# Iowa State Univ. of Science and Technology, Ames.
HIGH MAGNETIC FIELD PROPERTIES OF GADOLINIUM, TERBIUM, AND HOLMIUM
Clarence Michael Cornforth (Ph.D. Thesis) Feb. 1969 81 p refs
(Contract W-7405-eng-82)
(IS-T-277) Avail: CFSTI

A vibrating-sample magnetometer was used to measure magnetizations of Gd, Tb, and Ho in fields up to 100 kOe. Gadolinium was found to have a spontaneous saturation magnetization at 4.2°K of 7.49 μ_B per atom and a high-field susceptibility of 3.3×10^{-5} emu/g-Oe. The density of states at the Fermi energy was calculated to be 3.3×10^{34}/erg-cm^3 and the interaction energy between ions and conduction electrons found to be 1.26×10^{-13} erg. Terbium had a spontaneous saturation magnetization at 4.2°K of 9.28 μ_B per atom and a high field susceptibility of 7.3×10^{-5} emu/g-Oe. Calculations of the density of states at the Fermi energy and the interaction energy between ions and conduction electrons gave 5.74×10^{34}/erg-cm^3 and 4.3×10^{-14} erg, respectively. A transition from antiferromagnetic structure to antiphase structure was found for holmium at 12°K. Author (NSA)

N69-33882# California Univ., Los Angeles. School of Engineering and Applied Science.
RESEARCH ON SOLID STATE HETERODYNE DETECTORS FOR ULTRASTABLE OPTICAL SOURCES Final Report, 15 Jun. 1966–14 Jun. 1968
C. R. Viswanathan Apr. 1969 67 p
(Contract DA-28-043-AMC-02341(E))
(AD-688670; UCLA-69-10; ECOM-02341-F) Avail: CFSTI CSCL 20/12

The study of the field enhanced photoelectric effect included both theoretical and experimental investigations. The theoretical part involved the calculation of the energy band structure of tungsten, molybdenum and tantalum and the calculation of the periodic Schottky component of the photocurrent under high electric fields. The experimental part consisted of the measurement of the periodic Schottky emission from tungsten, molybdenum and tantalum into vacuum and of the study of electron emission between solid interfaces. Good agreement between theory and experiment was found in all cases. Author (TAB)

N69-33913# California Univ., Los Angeles.
PROPAGATION OF SOUND IN MATTER Final Report
Isadore Rudnick Mar. 1969 14 p refs
(Contract Nonr-233(48))
(AD-687523) Avail: CFSTI CSCL 20/1

The central theme is propagation of sound in matter and the work reported includes studies in solids, liquids and gases. Author (TAB)

N69-33918# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
INTERACTIONS AND CORRELATIONS OF ELECTROMAGNETIC FIELDS Final Report, 1 Mar. 1965–28 Feb. 1969
L. Mandel Mar. 1969 27 p refs
(Contract AF 49(638)-1532)
(AD-687496; AFOSR-69-0783TR) Avail: CFSTI CSCL 20/6

The report covers work on interference properties of single photons, photon statistics, photoelectric correlation studies of laser beams, quantum and classical theories of optical coherence, and coherence effects in holography. The research resulted in 17 scientific publications, summaries of which are given. Two graduate students obtained their Ph.D. degrees on the basis of research supported by the contract. Also listed are 52 outside lectures dealing with various aspects of the work, presented during the period of the contract. Author (TAB)

N69-33925# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
EXISTENCE OF PHASE TRANSITIONS FOR QUANTUM LATTICE SYSTEMS
J. Ginibre 20 Jun. 1969 53 p refs
(LPTHE-TH-69/41) Avail: CFSTI

It is proven that the following lattice systems: (1) anisotropic Heisenberg model; (2) Ising model with transverse magnetic field; and (3) quantum lattice gas with hard cores extending over nearest neighbors, exhibit phase transitions if the temperature is sufficiently low and the transverse (or kinetic) part of the interaction sufficiently small. Author

N69-33951*# Nevada Univ., Reno.
SPACE MAGNETIC EXPLORATION AND TECHNOLOGY Symposium, Aug. 1967

Ernest J. Iufer, ed. (NASA. Ames Res. Center) 1967 396 p refs Proc. of symp. sponsored by NASA. Ames Research Center and Nev. Univ., Gen. Univ. Extension Continuing Educ., Reno, Nev., 28–30 Aug. 1967
(NASA Order A-92986)
(NASA-CR-73350) Avail: CFSTI CSCL 20C

Presented is information on recent developments bearing on generation, compensation, measurement, and calculation of very low frequency magnetic fields. Results of recent spacecraft developments are described, together with reviews of recent research. For individual titles, see N69-33952 through N69-33978.

N69-33953*# Nevada Univ., Reno.
A REPORT ON THE SECOND INTERNATIONAL CONFERENCE ON MAGNET TECHNOLOGY
A. A. Halacsy *In its* Space Magnetic Exploration and Technol. 1967 p 19–25 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 20C

Magnetic technologies related to weak magnetic fields and superconducting coils are discussed. Rare metals like holmium and dysprosium are used as superconducting cores in mass spectrometers with good results. A rapid mapping magnetic measuring system is developed that uses a rotating coil gauss meter for digital pulsed field measurements with automatic data analysis. Also described are field measuring systems for bubble chambers and methods for theoretical field calculations. G.G.

N69-33954*# Oklahoma Univ., Norman. School of Geology and Geophysics.
SOME FEATURES OF SECULAR VARIATION OF THE GEOMAGNETIC FIELD
Robert L. DuBois *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 26–31 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 20C

To describe completely secular variation, data are needed from preobservatory time, and archaeomagnetic studies provide such information. Archaeomagnetism uses the standard instrumentation of paleomagnetism and determines the paleodirection of the geomagnetic field from the direction of remanent magnetism of specimens of baked clays. Specimens for these studies are collected from fire hearths or kilns at various archaeological sites and range in age from 300 B.C. to modern. The dating is based on a tree-ring chronology. Results suggest that values for inclination of the earth's magnetic field, as adjusted to Tucson, Arizona, range from 40° to 60° and can be represented on an irregular curve. Changes in declination are from 13°E to 13°W. Secular variation as indicated by a polar data representation curve (PDRC) has a 1350-year period of counter-clockwise motion that encircles the present geographic pole. The PDRC has three small clockwise loops, approximately 120° apart, and of about 200-400 years duration. The angular standard deviation of all site mean directions is 5.9° Author

N69-33955*# Argonne National Lab., Ill.
THE ARGONNE 16-FT BORE SUPERCONDUCTING MAGNET
J. R. Purcell *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 32-40 refs Sponsored by AEC (See N69-33951 19-23)
Avail: CFSTI CSCL 20C

This paper describes the design approach for building a 16-ft bore superconducting magnet for a large 12-ft liquid hydrogen bubble chamber. Both conventional (hollow copper conductor) and superconducting coils were designed in considerable detail and compared on a parameter-to-parameter basis. The superconducting coil was chosen because it compared favorably with the conventional coil. Its design appears to be safe, feasible, and reliable, and - in addition - large savings in power costs can be realized. The magnet system is designed to provide an 18 kG field. To produce the same magnetic field in a conventional coil, 10 MW of power is required plus an additional 750 kW for the cooling-water circulation pumps. The power requirements of the superconducting coil are not expected to exceed 200 kW, which is almost entirely for refrigeration. This expectation is based on steady-state operation and will depend to some extent upon the efficiency of the thermal insulation. Detailed capital cost estimates were made for both the conventional and superconducting systems. Author

N69-33956*# Stanford Research Inst., Menlo Park, Calif. Low Temperature Physics Dept.
REVIEW OF SUPERCONDUCTING MAGNETOMETERS
Victor W. Hesterman, William S. Goree, and Frank M. Chilton *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 41–64 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 20C

Applications of several of the unique properties of the superconducting state to measure small magnetic fields will be reviewed. The techniques to be described depend primarily on the following properties: zero electrical resistance, allowing the flow of persistent currents; the Meissner effect, and superconducting tunneling. Several different magnetometer circuits are described, and their relative merits, methods of signal readout, potential improvements, and intrinsic noise sources are discussed. One type of circuit consists of a superconducting pickup coil wound on a core that is thermally switched between the superconducting and normal states. It can make use of the Meissner effect, the quantized-flux effect, or both. Another type of circuit uses the magnetic field dependence of the critical dc Josephson tunneling current. Author

N69-33958*# Argonne National Lab., Idaho Falls, Idaho.
MAGNETIC FIELD COMPUTATIONS AND MEASUREMENTS ON THE EXCITERS FOR THE ARGONNE PION FOCUSING HORN
H. Vogel and S. Vegors (Idaho State Univ.) *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 79–88 refs Sponsored by AEC (See N69-33951 19-23)
Avail: CFSTI CSCL 20C

An analysis of the stray field of a steel core with toroidal winding is used for the design of a pion focusing horn with an azimuthal field sufficiently free of asymmetries. Results show that the field due to the conductor spacings is negligible as long as the spacing is uniform. Field measurements demonstrate that the field in the cross direction to the inner conductor is sufficiently independent of excitation current and that this field saturates as a result of its origin from the end of the steel strip of which the core is wound. When the horn is pulsed to 300 kA the radial field component at the conductor is expected to be about 1 gauss. G.G.

N69-33959*# Denver Univ., Colo.
SYSTEMS OF COILS TO PRODUCE MAGNETIC FIELDS OF PRESCRIBED UNIFORMITY IN REGIONS OF DESIRED SHAPE
George A. Rinard *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 89–102 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 20C

Most coil systems produce uniform fields over a region that is roughly spherical. The system is more efficient if the shape of the region of uniformity matches the experiment. This paper

describes a technique for determining the arrangement of the coils to produce prolately or oblately spheroidal volumes of uniformity. The method is based on expanding the field along a ray in a basic set of polynomials, as, for example, Tschebyschaff polynomials. Systems with very high uniformity may be designed to produce highly eccentric volumes of uniformity. The results are presented in a form so that given the eccentricity of the region and the degree of uniformity, one may uniquely determine the coil configuration and currents. Although only circular coils are considered, the method is directly applicable to square and other geometrically shaped coils. Author

N69-33971*# Philco-Ford Corp., Philadelphia, Pa. Space and Reentry Systems Div.
MAGNETIC CLEANLINESS PROGRAM FOR THE LUNAR SURFACE AND PIONEER MAGNETOMETERS
L. Howard Roberts *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 271–289 (See N69-33951 19-23)
Avail: CFSTI CSCL 20C

This paper outlines the program required to build space flight equipment conforming to strict "magnetic cleanliness" specifications. The selection of parts, materials and construction techniques utilizing both integrated circuits and discrete components are discussed in terms of the design and development of the Pioneer interplanetary magnetometer and the Lunar Surface Magnetometer. Magnetic test data produced by these programs are summarized and analyzed. Author

N69-33974*# Colorado Univ., Boulder.
NEW NONLINEAR MAGNETIC ANALYSIS OF SATURATED ELECTROMECHANICAL ENERGY CONVERTERS
E. A. Erdelyi *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 314–338 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 20C

The methods of solution presented here for scalar-magnetic and vector-magnetic problems are well suited for the predetermination of the behavior of electrical devices incorporating nonlinear ferromagnetic material. The quasi-Laplacian and Poissonian partial differential equations apply to the quasi-stationary regime of the devices and can be used with great advantage for many other devices, like accelerator magnets and for the analysis of magnetohydro-dynamic energy converters. The computational procedures described could also be easily adapted to heat-transfer, fluid mechanics, and other problems of mathematical physics. Author

N69-33978*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
APPLICATION OF RESONANCE TECHNIQUE FOR MEASURING SATELLITE MAGNETIC DIPOLE MOMENT
Barry E. Tossman *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 379–398 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 20C

This paper presents the theory and application of a resonance technique which is especially designed to measure small dipole moments. In using this technique, the satellite is suspended by torsion wires in a controlled magnetic field. By changing the magnetic field sense in synchronism with the natural torsion suspension frequency the satellite is driven into resonance. The rate of change of amplitude is a direct measure of dipole moment. This resonance technique has been successfully employed by the Applied Physics Laboratory in measuring and compensating dipole moments on 12 satellites. Testing methods have been improved to the extent that dipole moments as small as 50 pole-cm have been detected on satellites weighing up to 500 pounds. This paper discusses the application of resonance testing to several of the larger spacecraft and compares the results of dipole moment trim measurements to their in-flight attitude performance. Author

N69-33980*# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
CONTRIBUTION TO DIFFRACTION THEORY [CONTRIBUTION A LA THEORIE DE LA DIFFRACTION]
Nicholas Chako (Ph.D. Thesis–Paris Univ., 22 Nov. 1966) Apr. 1969 199 p refs In FRENCH; ENGLISH summary
(CEA-R-3151) Avail: CFSTI

The first part of this report is concerned with a general and detailed treatment of the modern theory of diffraction. The rigorous theory is formulated as a boundary value problem of the wave equation or Maxwell equations, but it has not been realised, even for simple optical instruments, due to the complicated character of the boundary conditions. Recent developments clearly show the nature of the approximations in the classical theories of Fresnel and Young, later formulated in a rigorous manner by Kirchhoff and Rubinowicz, and also in the insufficiency in explaining a number of diffraction phenomena. A study of the limitations of these approximate theories and the recent attempts to improve them has also been made. The second part is devoted to a general mathematical treatment of the theory of diffraction of optical systems including their aberrations. After a general and specific analysis of geometrical and wave aberrations along classical and modern (Nijboer) lines, the diffraction integrals representing the image field at any point in image space explicitly has been evaluated when the aberrations are small. These formulae are the generalizations of results obtained by previous investigators. The Zernike-Nijboer theory of aberration has been generalised, not only for rotational systems, but for non-symmetric ones as well, including the case of non-circular apertures. The latter study was carried out by introducing orthogonal functions or polynomials over such aperture shapes. These results are valid for small aberrations, i.e. where the deformation of the emerging wave front is less than one wavelength from the ideal. If the aberrations are large, then one must employ the method of stationary phases. A complete mathematical treatment of this method of evaluating multiple integrals containing a large parameter will be published later. A detailed development of the diffraction theory of corpuscular waves by an electron optical system, satisfying a Schrödinger equation is also presented. Author (ESRO)

N69-34108*# Bonn Univ. (West Germany) Inst. for Astrophysics.
A DISPROOF OF BOHR-VAN LEEUWEN'S THEOREM
J. Pfleiderer [1969] 35 p refs Sponsored by ESRO
Avail: CFSTI

The derivation of the theorem is reconsidered and some physical errors in the assumptions are stressed. The derivation is repeated using a time-independent Hamiltonium and closed systems and ignoring the balance of momentum and angular momentum. The equilibrium state is given by the Meissner effect of superconductivity rather than by vanishing diamagnetism. Some steps involved in these derivations are discussed in detail. Author (ESRO)

N69-34131*# National Physical Lab., Teddington (England). Aerodynamics Div.
AN OUTLINE GUIDE TO CRITERIA FOR THE LIMITATION OF URBAN NOISE
D. W. Robinson Mar. 1969 47 p refs
(NPL-AERO-Ac-39) Copyright. Avail: CFSTI

A review is given of the steps involved in relating noise emitted in urban areas to the disturbance caused to the community, with special reference to transportation noise. An outline of existing methods of rating individual noises and of successions of noises is presented. From the latter a common measure, termed noise pollution level, emerges which is derived in a simple manner from physical quantities and which summarizes the disturbing character of a complex noise environment. Suggestions for noise limits are included. Author (ESRO)

N69-34161# National Physical Lab., Teddington (England). Aerodynamics Div.
PROCEDURE FOR CALCULATING THE LOUDNESS OF SONIC BANGS
D. R. Johnson and D. W. Robinson Feb. 1969 30 p refs
(NPL-AERO-Ac-35) Copyright. Avail: CFSTI

In a previous paper the subjective magnitude of sonic bangs was shown to be calculable from waveforms recorded during field experiments, using an adaptation of established loudness calculation procedures. The method used previously is now applied to model waveforms based on likely values of overpressure, duration and rise time with allowance for interaction between incident and ground reflected shock waves. The determination of the energy spectrum by Fourier analysis of the waveform is described first; the way in which the standard loudness calculation for continuous sounds is adapted to the case of brief transients, such as sonic bangs with high levels of very low frequency energy, is then given in detail and summarized in an appendix. The results of applying the procedure to waveforms broadly within the range anticipated from first generation supersonic transports, are quoted in graphical form: for a given nominal peak overpressure, loudness level is found to vary by as much as 25 phons for rise times and delays between 0 and 16 ms. Finally, it is shown that loudness levels may be considerably intensified by focussing such as may be produced by manoeuvring aircraft. Author (ESRO)

N69-34167# Princeton-Pennsylvania Accelerator, Princeton, N.J.
ADDITION OF AG FEATURES TO PPA
K. Prelec and A. Pasanen 17 Jan. 1969 29 p refs
(Contract AT(30-1)-3217)
(PPAD-657-D) Avail: CFSTI

Results of numerical calculations performed for two different strong focusing additions to the Princeton–Pennsylvania Accelerator are presented. One is an alternating structure achieved by means of either pole face windings or pole face tips (the latter would convert PPA into an AG machine), and the other is a double spiraling quadrupole system, which in its ideal form is equivalent to a quadrupole with continuously changing gradients. The second system is referred to as the azimuthally varying (AV) quadrupole. Author (NSA)

N69-34201# Utah State Univ., Logan. Electro-Dynamics Labs.
MATHEMATICAL ENHANCEMENT OF THE SPECTRAL RESOLUTION OF FOURIER SPECTROSCOPY TECHNIQUES
R. Lynn Kirlin and Alvin M. Despain Oct. 1968 170 p refs
(Contract AF 19(628)-5916)
(AD-688504; AFCRL-69-0034; SR-6) Avail: CFSTI CSCL 20/6

The problem of mathematically increasing the spectral resolution of Fourier spectroscopy techniques is examined. The use of prolate spheroidal wave functions in a series expansion of an interferogram is investigated in detail in order to improve spectral resolution while allowing a decrease in superfluous signal-to-noise ratio. Resolution gain is shown to be proportional to the number of terms in the series: 4WT/T terms essentially extrapolates the signal from T to T and gives a resolution gain of TT=K. The integral square error due to series truncation, interferogram noise, timelimiting, and computer programming limitations is formulated quantitatively. When exact analytical extrapolation of the noisy interferogram is assumed, an approximate one-to-one tradeoff between signal-to-noise ratio and resolution may theoretically be achieved. Practicalities involved in the numerical generation of the spheroidal functions and the numerical correlation are shown to be serious limitations to the application of the theory. Thus, only problems dealing with small time-bandwidth products (2 piWT < 10) may be expected to yield resolution gains much greater than two. A method using small portions of the band, and, therefore a small time-bandwidth product, is introduced which is applicable if the major part of the signal energy is concentrated in that band. The theory presented is equally applicable to optical resolution problems. Author (TAB)

N69-34237# Ion Physics Corp., Burlington, Mass.
HIGH VOLTAGE BREAKDOWN STUDY Quarterly Progress Report, 16 Aug.–15 Nov. 1968
W. R. Ball, P. C. Bolin, M. J. Mulcahy, F. Y. Tea, and A. Watson Apr. 1969 116 p refs
(Contract DA-28-043-AMC-00394(E); ARPA Order 517)
(AD-688671; ECOM-00394-16; QPR-16) Avail: CFSTI CSCL 20/3

The results of treatments are reported from a 32-block, 5-factor, full-factorial experiment now underway to investigate the main effects and interactions of the following factors: anode and cathode material (copper and aluminum), electrode treatment (hydrogen or vacuum fired), anode size and shape (Bruce or sphere). By a process of stacking, the effect of a transverse magnetic field, exposure and energy storage are also investigated. Author (TAB)

N69-34239# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
ASSESSMENT AND DEVELOPMENT OF METHODS OF ACOUSTIC PERFORMANCE PREDICTION FOR JET NOISE SUPPRESSORS
Derek Middleton and Patrick J. F. Clark Apr. 1969 48 p refs
(Grant AF-AFOSR-872-67)
(AD-687475; UTIAS-TN-134; AFOSR-69-0780TR) Avail: CFSTI CSCL 20/1

The acoustical behaviour of certain nozzles designed to reduce the exhaust noise from turbo-jet engines has usually been established by direct measurement. The need for a simple yet adequate method of prediction of such behaviour is clear. The paper reviews the quasi-empirical approaches which have been adopted in the past, and paying particular attention to methods suggested by Eldred to deal with the power spectral density and Lee for deriving directivity patterns, develops these for application to (axisymmetric) nozzles where the elements are not all of the same size. The measure of agreement between predicted levels and typical results quoted in the literature is generally reasonably good. Some implications of the theory are discussed. Additionally, a mathematical model is presented to calculate the noise reduction due to the interference of adjacent twin round jets. Author (TAB)

N69-34270# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
METHOD OF NON-EQUILIBRIUM STATISTICAL AND GENERALIZED KINETIC EQUATIONS
L. A. Pockrovski 1968 30 p refs In RUSSIAN; ENGLISH summary Presented at 2nd Conf. on Statist. and Phys. Kinetics, Kiev, Sep. 1968
(ITF-68-78; CONF-680949-5) Avail: AEC Depository Libraries

Construction of the generalized kinetic equations by means of Zubarev's nonequilibrium statistical operator is being considered. The method, as well as that of Peletminski and Jatsenko is proved to lead to the same results as far as the systems with a weak interaction are concerned. The application of the methods for deriving Redfield-type kinetic equations for the weakly interacting systems is considered. The equation obtained contains the Bloch equation as a particular case. Essentially, the correlations of the detailed balance are obtained for the probabilities of the immediate transition without additional assumptions. Author (NSA)

N69-34272# National Physical Lab., Teddington (England). Aerodynamics Div.
THE CONCEPT OF NOISE POLLUTION LEVEL
D. W. Robinson Mar. 1969 28 p refs
(NPL-AERO-Ac-38) Copyright. Avail: CFSTI

Different indices are in current use for expressing the nuisance value of successions of noises, according to the type of noise. It is shown that a single index, termed noise pollution level, accommodates the experimental results of surveys of aircraft and of motor vehicle noise. The same formula satisfactorily explains the results of laboratory tests in which noise intensity is traded against duration to maintain equal impressions of objectionableness. The index is based on two terms, one representing the equivalent continuous noise level on the energy basis, and the other representing the augmentation of annoyance when fluctuations of noise level occur. Various practical simplifications of the formula are discussed.
Author (ESRO)

N69-34398# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
ELECTRODYNAMICS OF MOVING MEDIA AND THE THEORY OF RELATIVITY [ELECTRODINAMICA CORPURILOR IN MISCARE SI TEORIA RELATIVITATII]
N. J. Ionescu-Pallas 1968 19 p In RUMANIAN; ENGLISH summary
(IFA-FT-72) Avail: AEC Depository Libraries

The electrodynamics of moving bodies is derived in a covariant form by using the concept of "Q-vector" (complex three-dimensional vector the square of which is a Lorentz invariant). The dynamical characterization of a Q-vector leads –by virtue of some simple and reasonable assertions– to the field equations of the conventional theory. As concerns the equations of the material, the conclusion is quite different. The standard approach, in which the electrical permeability (ϵ), the magnetical permeability (μ) and the electrical conductivity (λ) are considered as some four-scalars is proved to be in conflict with relativity theory. In order to overcome this difficulty, the insertion into electrodynamics of a four-vector of resistivity is proposed. After this completion, the relaxation time ($\epsilon/4\pi\lambda$) behaves under a change of the inertia frame according to the prescriptions of relativity theory. Thus, the electrodynamics of moving media becomes a relativistic theory not only by its covariant form but also by the conclusions derived from it. Finally, support for the four-vector of resistivity is achieved from relativistic thermodynamics.
Author (NSA)

N69-34451# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ACOUSTIC EMISSION SIGNAL ANALYSIS IN FLAT PLATES
C. E. Fitch, Jr. Apr. 1969 34 p
(Contract AT(45-1)-1830)
(BNWL-1008) Avail: CFSTI

An acoustic emission signal from a deformation or fracture mechanism is assumed to initiate as essentially a point source for detection frequencies in the range of a few megahertz or below. Approximate mathematical expressions for predicting the number of signal reflections and their time separations, and thus total expected signal durations, were derived and studied for flat specimen geometries. A 1/2-in. thick A-212-B steel plate was used to determine whether experimental observations could be predicted from approximate relationships derived. Both artificial and real acoustic emission sources were tested under a variety of conditions. Observations of good experimental agreement may provide a basis for optimizing signal detection in flat geometries. A preliminary study of pulse shapes and pulse durations was also conducted in experimental attempts to determine source depth as well as range.
Author (NSA)

N69-34452# California Univ., Livermore. Lawrence Radiation Lab.
BASEBALL 2 COIL FORM GEOMETRY AND FABRICATION
Manuel O. Calderon 27 Mar. 1969 13 p Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N.Mex., 8–11 Apr. 1969 Sponsored by AEC
(UCRL-71534; CONF-690407-17) Avail: CFSTI

The Alice Baseball 2 superconducting magnet presented unique problems in the choice of geometry and in the design of a coil structure that would enclose the conductor in a helium environment and resist the large distortion forces. The geometry and the relative size of the coil form in component and assembled state is illustrated and explained. Also discussed are some of the requirements and solutions involved in the selection of fabrication methods and in the choice of materials. Additionally presented are problems that were encountered during the actual production of this large coil form. Closing comments describe the present status of the construction.
Author (NSA)

N69-34455# Atomic Weapons Research Establishment, Aldermaston (England).
ELECTRIC FIELDS IN FLUX COMPRESSION DEVICES
C. S. Speight Feb. 1969 39 p refs
(AWRE-O-2/69) Avail: CFSTI: HMSO 5s 6d

A model of the electromagnetic field is presented, and application of the model to study the electric fields that arise during the process of flux compression, in such a way as to minimize the risk of breakdown in the design stage, is discussed.
NSA

N69-34456# Aerospace Corp., El Segundo, Calif. Lab. Operations.
EVALUATION OF PARABOLIC OPTICS FOR THE AEROSPACE LAMELLAR GRATING INTERFEROMETER
Research Report, Nov. 1968–Jan. 1969
Charles M. Randall and Jerome M. Dowling 28 Feb. 1969 22 p refs
(Contract F04701-68-C-0200)
(AD-688485; TR-0200(9260-01)-5; SAMSO-TR-69-151) Avail: CFSTI CSCL 20/6

The Czerny-Turner collimating system used in the Aerospace lamellar grating interferometer is shown to lead to significant instrumental line broadening. This system is compared with an off-axis parabolic mirror system, and the following conclusions are reached. (1) The instrumental line broadening of the parabolic mirror system will be an order of magnitude smaller than for the Czerny-Turner system. (2) The coma of the parabolic mirror system is negligible. (3) The wavefront distortion of the parabolic mirror system is less than that of the Czerny-Turner system.
Author (TAB)

N69-34471# California Univ., Livermore. Lawrence Radiation Lab.
MAGNETIC FIELD AND FORCE BY FINITE ELEMENT TECHNIQUES
Anthony K. Chargin and Carl O. Henning 27 Mar. 1969 13 p refs Presented at Symp. on Eng. probl. of Fusion Res., Los Alamos, N. Mex.8–11 Apr. 1969 Sponsored by AEC
(UCRL-71538; Conf-690407-7) Avail: CFSTI

In the design of modern superconducting magnets a detailed knowledge of magnetic fields and forces within the conductor bundle is essential for predicting successful magnet operation. Any magnet configuration can be approximated with a finite number of several fundamental elements. A computer program is used to sum the electric and magnetic effects of all the elements. The technique of selecting the type of element and the number of each

is extremely important in obtaining correct results. The parameters to consider in numerically approximating a conductor bundle are presented. Relationships of these parameters are developed to aid in optimizing the selection of the type and number of fundamental elements for the desired accuracy. The correlation between the numerical approximation and the experimentally measured magnetic fields in several test magnet configurations was excellent. Author (NSA)

N69-34528# Academy of Sciences (USSR). Moscow. Inst. Atomnoi Energii.

CALCULATION OF THE FOCUSING PROPERTIES OF SECTOR MAGNETIC AND FIELDS OF AXIALLY SYMMETRIC TYPE WITH CURVED-LINE BOUNDARIES (MONOCHROMATORS, ANALYZERS, SEPARATORS, MIRRORS, AND OTHER SYSTEMS FOR THE CHANNELIZATION OF BEAMS OF CHARGED PARTICLES)

B. V. Panin 1968 100 p refs In RUSSIAN
(IAE-1667) Avail: AEC Depository Libraries

On the basis of Artsimovich's principle for calculating the focusing of divergent, charged-particle beams, an expression was developed for determining aberrations in axial-symmetric systems with straight-line boundaries. This problem was further examined by developing an ion-optical scheme, involving both crossed and separate magnetic and electric axial-symmetric fields with curved boundaries. Only boundaries, the equations of which may be expressed as polynomes in cylindrical coordinates, were considered. The properties of the ion-optical system which depend only on their geometric parameters were analyzed, neglecting the terms in the equation of motion which involve the interaction of the focusing particles and the collective processes of the beam-plasma system. The method obtained was found to be well suited to calculate a large number of analyzing and guiding systems for nonrelativistic charged-particle beams. NSA

N69-34589# Oak Ridge National Lab., Tenn.

SOME EDDY-CURRENT PROBLEMS AND THEIR INTEGRAL SOLUTIONS

C. V. Dodd, J. W. Luquire, W. E. Deeds, and W. G. Spoeri Apr. 1969 89 p refs
(Contract W-7405-eng-26)
(ORNL-4384) Avail: CFSTI

Integral representations were obtained for the vector potential produced by a circular coil for a number of different geometrical configurations. From the vector potential any observable electromagnetic induction phenomenon can be calculated. The present solutions are limited to cases with axial symmetry and linear media. The solutions are in the form of multiple integrals of ordinary and modified Bessel functions. The configurations that were solved include coils with rectangular cross sections in the following locations: above or on each side of a two-conductor sheet bounded by parallel planes, between two parallel-plane conductors, encircling a tube or a rod consisting of one metal clad on another, and inside a tube. The electromagnetic phenomena that were calculated include the coil impedance, the phase and amplitude of the voltage induced in pickup coils, the effects of small spheroidal defects on the impedance and phase, and the forces generated in a metal by the eddy currents. Author (NSA)

N69-34591# Vitro Labs., West Orange, N.J.

DEVELOPMENT OF VACUUM ULTRAVIOLET RADIATION SOURCE Final Report, 20 Oct. 1965–20 Feb. 1969

Maurice E. Levy Apr. 1969 87 p refs
(Contract AF 19(628)-5724)
(AD-687506; VL-2418-41-0; AFCRL-69-0182) Avail: CFSTI
CSCL 20/6

A plasma arc radiation source of unusual geometry has been developed and tested. The source provides useful radiant emission in the vacuum ultraviolet (VUV) range of the spectrum, 350 to 1000 A. The plasma arc operates nominally at pressures ranging from 300 to 1000 torr, arc currents from 100 to 300 A and power levels up to 10 kW. Rare gases are used as the discharge media. The source emits a combination of continuum and line radiation. The continuum radiation is due to radiative recombination of ions and electrons to the ground state of the neutral atom. The various continua thus produced cover the entire range from 350 to 1000 A. The plasma radiation source has applications in the VUV as a background source for the photoelectric measurement of absorption cross sections, as a solar simulator, in radiation damage studies for materials and coatings and in studies of plasma radiation processes. Author (TAB)

N69-34598# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Institut.

TOWARD THE TASK OF THE NONRIGID ROTATOR [K ZADACHE O NEZHESTKOM ROTATORE]

E. V. Gai 1968 14 p refs In RUSSIAN
(FEI-139) Avail: AEC Depository Libraries

The motion of the center of mass, the rotation of the whole system, including volume and surface oscillations are of great importance for determining the state of quantum-mechanical systems. Transition to quantum mechanics is achieved by substituting generalized pulses in the classical Hamiltonian of the motion of the solid. The rotation of a molecule may be studied by considering the solid as a system of material points at unknown distances from each other, using the approach employed in nuclear physics. This approach may be used only if it is known that the system has a rotational spectrum derived from its collective motion. This problem was examined on the basis of the study of the eigenvalues and eigenfunctions of the Hamiltonian. NSA

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-33222# Centre d'Etudes et de Recherches Atomiques Militaires, Fort d'Aubervilliers (France). Laboratoire Central de l'Armement.

STUDY OF THE CHARACTERISTICS OF THE PHOTOLUMINESCENT DOSIMETER IN THE SILVER PHOSPHATE SCANNER, 1959–1967 [ETUDES DES CARACTERISTIQUES DES DOSIMETRES PHOTOLUMINESCENTS AU PHOSPHATE D'ARGENT ET DES LECTEURS ASSOCIES, 1959–1967]

Annie Vallee Jan. 1968 53 p refs In FRENCH Prepared in cooperation with CEA and private ind.
Avail: CFSTI

Cooperation between private business and the Atomic Energy Commission of France in the development of suitable, sensitive dosimeters for military purposes is reported. Seven versions of three different scanner prototypes were prepared. Responses of the lenses, the radiation sensitivity (gamma rays and thermal neutrons), the response to dry heat and cold (−55°C to 70°C), internal, and ambient temperature, and other instrumental characteristics were compared. From the data, the Japanese dosimeter was considered

superior to the others and corrections to the French model were made. The final French version demonstrated precision of the order of 5% between one and many thousands of rads. Comments on the progress still to be made in the development of a photoluminescent dosimeter which would be sensitive to radiation sources but insensitive to internal temperature effects are offered.
Transl. by M.H.E.

N69-33274*# National Aeronautics and Space Administration, Washington, D.C.
MONTE CARLO COMPUTATION OF AERODYNAMIC CHARACTERISTICS OF BODIES OF COMPLEX SHAPE IN FREE MOLECULE FLOW
A. A. Bogacheva et al Jul. 1969 11 p refs Transl. into ENGLISH from Zh. Vichislitel'noi Mat. i Mat. Fiz. (Moscow), v. 8, no. 6, 1968 p 1395--1402
(NASA-TT-F-12360) Avail: CFSTI CSCL 20H

The Monte Carlo method is effective not only for internal but also for external flow. In addition, the difficulties that arise in computation of aerodynamic characteristics of concave bodies having angular points, and especially bodies of complex shape and groups of bodies, disappear with the use of this method. The overall procedures for the Monte Carlo method of solving problems of free molecular flow over bodies were analyzed, and the aerodynamic characteristics on the internal surface of a hemisphere situated at the angle of attack were investigated. Author

N69-33350# Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.
THE USE OF RADIOACTIVE TRACERS IN ITALIAN INDUSTRIES: CURRENT AND FUTURE CONDITIONS [L'USO DEI TRACCIANTI RADIOACTTIVI NELLE INDUSTRIE ITALIANE: SITUAZIONE PRESENTE E PROSPETTIVE]
P. G. Caldera 1968 16 p In ITALIAN Presented at CNEN Div. of Health Control and Protect. Seminar, Rome, 15 Jul. 1968
(SORIN-152; M/356) Avail: CFSTI

The use of radioactive isotopes as tracers in general, and particularly in industry, is investigated based on two characteristics of the isotopes. The first is the radiation emission which can readily be detected, even when present in extremely small quantities. The second is that the chemical properties are the same as those of the inactive isotopes of the same element. The industrial uses described are: (1) determining the proper homogeneity of mixtures, such as chemicals, cement, and pastes; (2) measuring the velocity of flows in pipelines, conductors, and channel openings; (3) measuring volumes and determining weights; (4) finding leakages in pipelines; and (5) controlling different stages in chemical processes such as filtration, separation, piping, and distillation.
Transl. by F.O.S.

N69-33388# International Centre for Theoretical Physics, Trieste (Italy).
FINITE ENERGY SUM RULES WITH THE CHENG REPRESENTATION
A. D. Karpf Jan. 1969 18 p refs Submitted for publication Sponsored by Ger. Bundesmin. für Wiss. Forsch.
(IC-69-13) Avail: CFSTI

The unitary Cheng representation for the partial wave amplitudes is adopted to calculate the left-hand side of a FESR in the -system. The results confirm the nonsense choosing mechanism for the ρ-meson and give a hint for t-dependence of the remaining residuum function $\beta(t)$. Author (ESRO)

N69-33398# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
RADIATIVE VECTOR AND PSEUDOSCALAR MESON DECAYS. APPLICATION TO THE POSITRON ELECTRON YIELDS ETA MESON PHOTON
E. Cremmer Jun. 1969 17 p refs
(Rept-69/35) Avail: CFSTI

The radiative vector and pseudoscalar meson decay widths are calculated using vector meson dominance model, SU(3) symmetry and taking into account ω-ϕ and η-X_0 mixings. The results are applied to the calculation of the cross section for the annihilation.
Author

N69-33416*# Ling-Temco-Vought, Inc., Dallas, Tex.
INVESTIGATION OF BREMSSTRAHLUNG PRODUCTION IN SPACECRAFT MATERIALS
W. E. Dance and W. J. Rainwater Washington NASA Jul. 1969 215 p refs
(Contract NAS1-7772)
(NASA-CR-1377; Rept-0-71100/8R-18) Avail: CFSTI CSCL 20H

Bremsstrahlung spectra resulting from bombardment of typical spacecraft materials by monoenergetic electrons were experimentally determined in the electron energy range 0.5 to 2.5 MeV. Spectral measurements were made for five angles of electron incidence using a NaI(T1) spectrometer. Integration of the spectra over all possible angles of incidence, with subsequent conversion of the result to dose, yielded for the case of a spherical shell, the bremsstrahlung dose spectra at each electron energy due to a unit omnidirectional flux of electrons. Types of target materials investigated are: 1) solid alloy slabs, 2) laminated alloys, and 3) ablative materials backed by alloyed honeycomb structures. Slab thicknesses of the alloys Ti 6A1 4V, A1 7075-T6, and Stainless 321 were chosen so as to stop 2.5 MeV electrons. Bremsstrahlung dose values inside spherical shells of the target materials were determined, assuming the omnidirectional electron environment found in synchronous orbits. Author

N69-33460# Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Biologie.
SEPARATIONS IN THE ACTINIUM-URANIUM SERIES USING ALPHA-SEMICONDUCTOR SPECTROMETRY [TRENNUNGEN IN DER AKTIN-URAN-REIHE UNTER VERWENDUNG DER ALPHA-HALBLEITER-SPEKTROMETRIE]
W. Mueller *In* Soc. Europeenne de Protec. Contre des Rayonnements Detectors in Radiation Protec. and Radiation Measurement Tech. Sep. 1967 p 88-95 refs In GERMAN (See N69-33451 19-14)
Avail: CFSTI

An anion exchange method was developed for the separation of the long-lived decay products of ^{227}Ac, so that the decay products could be determined by α spectrometry. The preparation of the samples is described. The results obtained with α spectrometry are reported and typical α spectra of ^{227}Ac, ^{211}Bi, ^{223}Ra, and ^{227}Th obtained during the separation are given. The results showed that α spectrometry is a suitable analytical method.
NSA

N69-33478# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
POMERANCHON EXCHANGE AND p-p ELASTIC SCATTERING
M. Greco 7 May 1969 10 p refs *Its* Nota Interna No. 445
(LNF-69/30) Avail: CFSTI

A representation for the Pomeranchon exchange and the multiple scattering corrections is suggested, which contains crossing symmetry, asymptotic Regge behaviour, and obeys the duality

requirement of a nonresonating background. A very good description of the proton–proton elastic scattering is obtained in the diffraction, intermediate and large angle regions. Author

N69-33535*# California Univ., Berkeley. Lawrence Radiation Lab.
SEMICONDUCTOR DEVICES AND THEIR APPLICATIONS TO DOSIMETRY OF HEAVY-CHARGED-PARTICLE BEAMS
Mudundi R. Raju *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 55–57 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

Energy-loss measurements of protons of energies up to a maximum of 730 MeV and helium ions up to a maximum of 910 MeV, using lithium-drifted silicon detectors of different thicknesses up to 5 mm, agreed well with the values predicted by theory. Theories of fluctuations of energy loss of high and intermediate energy protons and of helium ions have been investigated by using semiconductor detector devices of various thicknesses and the results are found to be in good agreement with theory. In order to evaluate the LET distribution of heavy charged particles at the Bragg peak position, the energy distribution of these particles was measured by use of lithium-drifted silicon detectors thick enough to stop the beam, and was found to be much higher than expected. It appears that the modal energy of the heavy charged particles at the Bragg peak position is roughly 10% of the primary beam energy. K.R.G.

N69-33562# Naval Research Lab., Washington, D.C.
NRL VAN DE GRAAFF OPERATION Memorandum Report, Report, 1 Jul.–31 Dec. 1968
Feb. 1969 23 p refs
(AD-687392; NRL-MR-1984) Avail: CFSTI CSCL 20/7

The report is the second of a series of semiannual summaries on the operation and use of the NRL 5-MV Van de Graaff accelerator and associated instruments. Brief accounts of the research and development projects under way are included. Author (TAB)

N69-33578# Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.
PROBLEMS OF PRODUCTION AND UTILIZATION OF RADIOACTIVE ISOTOPES CONSIDERED IN PRIORITY TO SOME ASPECTS OF SURVEILLANCE [PROBLEMI DEI PRODUTTORI E DEGLI UTILIZZATORI DI RADIOISOTOPI DI FRONTE AD ALCUNI ASPETTI DELLA SORVEGLIANZA]
S. Todisco and G. A. Scassellati 1968 22 p In ITALIAN
Presented at 13th Nucl. Congr., Rome, 28–29 Mar. 1968
(SORIN-141; M/332) Avail: CFSTI

The problems of surveillance of radioactive isotopes are studied with a variety of actions for reducing risks. Some aspects of surveillance presented are: (1) the fundamental characteristics of radioactive materials, (2) the maximum dosage of exposure permissable, (3) detection techniques, (4) reduction of irradiation and contamination, and (5) prevention of accidents. Procedural aspects are also presented. It is concluded that the major problems in the production and utilization of radioactive isotopes are procedural rather than technical. Transl. by F.O.S.

N69-33610# Technisch Hochschule Munchen (West Germany).
MOSSBAUER EFFECT FOLLOWING THE BETA DECAY OF POLARIZED ER 169 NUCLEI [MOESSBAUEREFFEKT NACH DEM BETA-ZERFALL VON POLARISIERTEN ER 169-KERNEN]
Rudolf Geller (Ph.D. Thesis) 1969 41 p refs In GERMAN
Avail: CFSTI

Determined was the nucleus orientation in an excited intermediate state of the erbium 169 beta gamma decay cascade spectrum by evaluating the relative intensity of the hyperfine lines. The orientation of the intermediate state was determined through the function of the nucleus orientation at cascade ground state and the mixture ratio of beta decay matrix elements. Experimental results were obtained for the forbidden beta transition of erbium 169 to the 8.4 keV state of thulium 169 under cryogenic cooling. Transl. by G.G.

N69-33695# Forsvarets Forskningsanstalt, Stockholm (Sweden).
A STUDY OF THE NEUTRON INDUCED GAMMA ACTIVITY IN Mn-CONTAINING STEEL AND THE REDUCTION OF THE GAMMA RADIATION BY BORON SHIELDING
R. Jansson and L. Beckman Oct. 1967 8 p refs
(FOA-4-C-4320-23) Avail: CFSTI

The neutron induced gamma activity in ^{56}Mn in steel has been studied with 14 and 2.5 MeV neutrons entering a steel plate behind which a thermalizing medium was situated. The effect of a boronshield between the steel plate and the thermalizing medium has been investigated. The boron shield reduces the induced activity by capture of the reflected slow neutrons. The induced activity in iron through the reaction ^{56}Fe(n,p)^{56}Mn, produced by 14 MeV neutrons, was also studied. Author

N69-33704# Oak Ridge National Lab., Tenn. Physics Div.
EIGENVALUES FOR ELEMENTS FROM Z EQUALS 2 TO 103 IN A GOOD APPROXIMATION TO RELATIVISTIC HARTREE–FOCK SOLUTIONS
Thomas A. Carlson and B. P. Pullen Apr. 1969 31 p refs
(Contract W-7405-ENG-26)
(ORNL-4393) Avail: CFSTI

Eigenvalues have been calculated for all the shells of all the elements from Z = 2 to 103 in their ground states as free atoms. These values should be in good agreement with those computed from relativistic Hartree–Fock solutions. The values presented have been obtained by determining a relativistic correction as developed from self-consistent field calculations, both nonrelativistic and relativistic, in which exchange has been approximated in an identical fashion. Eigenvalues from nonrelativistic Hartree–Fock solutions are then multiplied by this relativistic correction to obtain the desired result. Comparison of the approximate eigenvalues with thhose calculated directly from relativistic Hartree–Fock solutions showa excellent agreement. Author (NSA)

N69-33707# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
PARAMETERS OF THE NEUTRON RESONANCES OF THE Rb 85 AND Rb 87 ISOTOPES
M. K. Grebenyuk, P. Sh. Kovach, H. Malecki, and I. M. Salamatin 1969 11 p refs In RUSSIAN
(JINR-P3-4357) Avail: AEC Depository Libraries

Transmission and neutron radiative capture measurements were performed on enriched ^{85}Rb and ^{87}Rb isotopes by the time-of-flight method in the pulsed fast reactor IBR. The parameters of 54 isolated resonances were obtained in the neutron energy range up to ≈20 keV. Author (NSA)

N69-33708# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
ON CONSERVATION OF ISOTOPIC SPIN IN THE REACTION He 3(t,d)He-4

Kim Syn Nam, G. M. Osetinskii, and V. A. Sergeev 1969 21 p refs In RUSSIAN
(JINR-P15-4299) Avail: AEC Depository Libraries

The angular distributions of deuterons from the reaction $^3He + {}^3H \rightarrow {}^4He + D$ were measured using the electrostatic generator of the Neutron Physics Laboratory (JINR) in the energy range of tritons 1 to 1.5 MeV. Within the experimental errors (1–1.5%) the angular distributions are symmetrical about 90° in the c.m.s. It is shown on the basis of Barshay–Temmer theorem that the symmetry obtained is due to the isospin conservation in the reaction studied. The upper limit of the amplitude ratio of forbidden and allowed isospin transitions is found to be ≈0.02. Author (NSA)

N69-33733# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
STATISTICAL WEIGHT OF THE STATE WITH AN ARBITRARY NUMBER OF OCTETS AND DECUPLETS
V. M. Maltsev, G. N. Remizov, and S. K. Smirnov 1969 13 p refs In RUSSIAN
(JINR-P2-4367) AEC Depository Libraries

An integral expression for the statistical weight of the state, containing an arbitrary number of octets and decuplets, was obtained. Author (NSA)

N69-33734# Joint Inst. For Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
LAGRANGIAN FORMALISM FOR TENSOR FIELDS WITHOUT ADDITIONAL CONDITIONS
R. P. Zaikov 1969 18 p refs In RUSSIAN
(JINR-P2-4301) Avail: AEC Depository Libraries

The Lagrangian formalism of tensor fields of any range without exception of the lower spins and with an arbitrary mass spectrum is considered. It is shown that the free field Lagrangian can be constructed from which follows positively definite energy. In this case the formalism is canonical. The interaction with the scalar field is considered. An explicit form of the tensor field casual Green function is given. Author (NSA)

N69-33748# Stanford Univ., Calif. High Energy Physics Lab.
THE CORRECTION OF SCATTERED-ELECTRON SPECTRA FOR RADIATIVE EFFECTS
Hall Crannell Jan. 1969 25 p refs
(Contract Nonr-225(67))
(AD-687711; HEPL-510) Avail: CFSTI CSCL 20/8

The distortions caused by the effects of nuclear and thick-target bremsstrahlung on the spectrum of scattered electrons obscure the actual elastic and inelastic cross sections. A method whereby the spectrum can be systematically corrected for these effects is presented. The method uses previous theoretical calculations of the radiative probabilities and employs an iterative technique for step by step correction of the spectrum. Uncertainties due to statistical errors in the measurement propagate through such a calculation. A formulation in which the uncertainties can be explicitly calculated is presented. Corrections to the calculations due to effects such as the change in cross section with change in electron energy are discussed. Special problems associated with the applications of digital computers to this technique are described. Author (TAB)

N69-33757# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
BEHAVIOR OF DIFFRACTION PEAK FOR ARBITRARY SPIN PARTICLES
Nguyen Ngoc Thuan 1969 6 p refs In RUSSIAN
(JINR-P2-4260) Avail: AEC Depository Libraries

Earlier studies of the author and A. A. Logunov, involving the determination of the width of the diffraction peak of particles with the participation of scalar particles a + b → c + d (II), in which it was shown that Δ^{LII} cannot decrease faster with increasing s(square of the energy) than const/ln²s, were followed up, showing that this behavior applies also to the case of particles with spins. An explicit expression was derived in the above function defining s. As an example, elastic scattering processes were examined, resolving the invariant spiral amplitudes into partial waves. NSA

N69-33773# Rome Univ. (Italy). Inst. of Physics.
DYNAMICAL SCALING LAWS AND TIME DEPENDENT LANDAU-GINZBURG EQUATION
C. Di Castro, F. Ferro-Luzzi, and J. A. Tyson (Bell Telephone Lab., Murray Hill, N.J.) 11 Mar. 1969 8 p refs Prepared jointly with Ist. Nazl. Fis. Nucl. /its Nota Interna No. 209.
Avail: CFSTI

It is shown that a self-consistent version of the time-dependent Landau-Ginzburg theory yields results in agreement with dynamical scaling. Author (ESRO)

N69-33782# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
ELASTIC ELECTRON SCATTERING FROM He 4
D. Vinciguerra and T. Stovall Dec. 1968 8 p refs
(PB-182954; LAL-1205) Avail: CFSTI CSCL 20H

The elastic electron scattering from He4 is explained in a nuclear model which considers the nucleons as moving in space-fixed potentials. Author (USGRDR)

N69-33797# Los Alamos Scientific Lab., N. Mex.
DELAYED NEUTRON KINETIC RESPONSE METHODS OF ASSAY
R. H. Augustson, H. O. Menlove, C. N. Henry, C. F. Masters, and G. R. Keepin [1968] 5 p refs Presented at Intern. Conf. on the Constructive Uses of At. Energy, Washington, D.C.
(Contract W-7405-ENG-36)
(LA-DC-9759; CONF-681101-18) Avail: CFSTI

Delayed neutron yields and kinetics were applied to the nondestructive detection, identification, and assay of fissionable nuclides. Experimental isotope discrimination ratios at 14 MeV for ^{235}U, ^{238}U, and ^{239}U, ^{238}U combinations are given. The technique can determine relative abundances typically to within 3% accuracy. NSA

N69-33799# European Organization For Nuclear Research, Geneva (Switzerland).
EXPERIMENTAL STUDY OF THE MECHANISM OF THE REACTION C-12 (NEGATIVE PION p) B-11 AT 1.04 GeV/c
A. O. Agan'yatts et al [1968] 20 p refs into ENGLISH from Russian Rept. ITEF-610 In FRENCH
(CERN-Trans-68-17; ITEF-610) Avail: AEC Depository Libraries

The characteristic conditions which are necessary for the identification of the $^{12}C(\pi^-,\pi^-p)^{11}B$ reaction mechanism are obtained. The ^{12}C proton width is determined. It is concluded that the pole mechanism dominates only in the region of recoil moments $\lesssim$ 100 MeV/c. Author (NEA)

N69-33815# European Organization for Nuclear Research, Geneva (Switzerland).
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH Annual Report, 1968
1968 196 p refs
Copyright. Avail: Issuing Activity

The history, annual progress, organization, and administration of CERN are presented. Areas reported are: (1) nuclear physics, including synchrotrons, track chambers, theoretical physics, and nuclear physics apparatus; (2) applied physics; (3) intersecting storage ring projects; and (4) administration, and personnel. Published articles and references are included. F.O.S.

N69-33825# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
SOME APPLICATIONS OF CHANNELOGRAPHY [QUELQUES APPLICATIONS DE LA CANALIGRAPHIE]
Hubert Couve Apr. 1969 65 p refs In FRENCH; ENGLISH summary
(CEA-R-3741) Avail: CFSTI

Channeling of charged particles in crystals was used to study crystalline defects in metals. The experimental device (isotropic source of α particles – metallic sheet – insulating detector) is very simple, and the images obtained on the detector are called 'channelographies'. The main results obtained are the following: 1. By obstructing the channels, the grain boundaries, twin boundaries and stacking faults decrease the transmission of charged particles. In the case of twin boundaries, it is possible to determine the orientation of different regions of the metal being studied. 2. By successive annealing of quenched or cold-worked sheets, one can observe the annihilation of defects and the recrystallization of the metal. In the case of platinum, the activation enthalpy of recrystallization is found to be (2.6 ±0.2)eV/at. 3. Planar channeling makes appear geometrical patterns, whose crystalline origin is not yet understood. The influence of gas bubbles (helium in aluminum) on the transmission of α particles has also been studied. Author (ESRO)

N69-33828# California Univ., San Diego. Dept. of Physics.
TWO KINDS OF BOSONS AND BOSE CONDENSATES
W. Kohn and D. Sherrington Apr. 1969 46 p refs Sponsored in part by NSF
(Contract Nonr-2216(11))
(AD-687713; TR-57) Avail: CFSTI CSCL 20/10

The paper deals with ordinary material systems, whose elementary constituents are fermions. It is pointed out that in such systems there can occur two kinds of bosons. Type I bosons are bound complexes of an even number of fermions (such as He4); and type II bosons are elementary excitations which are bound complexes of fermions and their holes (such as excitons). When the first type condenses a superfluid state results with so-called off-diagonal long range order; while when the second type condenses there is no superfluidity but a change in spatial order. Thus both kinds of long range order are related to Bose condensation. Author (TAB)

N69-33834# Columbia Univ., Irvington, N.Y. Nevis Labs.
THE DECAY BRANCHING RATIOS OF THE ETA SUP O MESON
Jewan Kim Apr. 1969 90 p refs
(Contract AT(30-1)-1932)
(NEVIS-170; CU-274) Avail: CFSTI

The decay branching ratios of the η^0 meson were measured. Combining these ratios with the measurement of ratio ($\eta^0 \rightarrow$ all neutral mode/$\eta^0 \rightarrow$ all charged mode) = 2.64 ± 0.23, the partial decay rates for the various η^0 decays are obtained. Author (NSA)

N69-33847# California Univ., Berkeley. Lawrence Radiation Lab.
CERN-LRL-RHEL SHIELDING EXPERIMENT AT THE CERN PROTON SYNCHROTRON
William S. Gilbert, Dennis Keefe, Joseph B. McCaslin, Kenneth B. Shaw (Rutherford High Energy Lab., Chilton, Engl.), Ronald D. Fortune (CERN, Geneva) et al Sep. 1968 358 p refs
(Contract W-7405-ENG-48)
(UCRL-17941) Avail: CFSTI

The high cost of shielding of high-intensity accelerators in the 100-GeV energy range has stimulated keen interest in the radiation problems associated with these accelerators. Proton beam loss, neutron spectra, radiation levels in the accelerator room, and transmission of radiation through earth shielding and along tunnels were measured at 14.6 and 20.4 GeV/c. In the course of data reduction, computer programs for the evaluation of neutron spectra were developed and a study made of the conversion of neutron spectra information to dose equivalent. The data obtained have been qualitatively explained by Monte Carlo calculations due to Ranft. The transmission of radiation through the earth shield was analyzed by a computer program FLUXFT through generalization of an empirical model. Excellent agreement is obtained with the experimental data. The success of the model in explaining the observed radiation field at the CPS gives confidence in extrapolation to accelerators in the energy region around 200 GeV. The transmission of radiation along tunnels was studied and successfully interpreted in terms of a simple model. All data used in the analysis programs, as well as almost all other data, are presented in tables. Author (NSA)

N69-33861# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy
RECTANGULAR DALITZ-PLOTS
G. I. Kopylov 1969 15 p refs In RUSSIAN
(JINR-P1-4281) Avail: AEC Depository Libraries

The two-dimensional diagrams of the state of several particles (like Dalitz-plot and triangle-plot) may be plotted as rectangle. Author (NSA)

N69-33862# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy
RESONANCES AS UNSTABLE SYSTEMS WITH A GREATER NUMBER OF INTERNAL STATES (PHENOMENOLOGICAL THEORY)
M. Lokaichek 1969 13 p refs In RUSSIAN
(JINR-P2-4348) Avail: AEC Depository Library

A quantum mechanical description of unstable particles is given. The description is based on the premise that every unstable particle has a greater number of internal states which can mutually change one into the other. Author (NSA)

N69-33866# Rome Univ. (Italy). Inst. of Physics.
β-DECAY OF HYPERONS
C. Marchioro, A. Prosperetti (CNEN), and A. Pugliese 13 Mar. 1969 23 p refs *Its* Nota Interna 212
Avail: CFSTI

The β-decay of hyperons is studied in the framework of the current SIxS current theory of weak interactions and the results are expressed in a manageable form for experimental purposes. Numerical calculations are performed for Λ Ξ –B decay and the information obtainable from experiments is discussed. Author (ESRO)

N69-33869# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
LIFE-TIME MEASUREMENTS OF EXCITED STATES IN SUP 182 RE
A. J. Akhmadzhanov, R. Broda, A. Z. Hrynkiewicz, J. Molnar, J. Styczen et al 1969 12 p ref
(JINR-E6-4311) Avail: AEC Depository Libraries

The life-times of the 235.7 keV and 263.2 keV levels in ^{182}Re, excited by the decay of ^{182}Os were measured using the delayed $\gamma-\gamma$ coincidence method. The following results were obtained: T1/2 = 0.57 ± 0.04 μ sec for the 235.7 keV level; T1/2 = 5.27 ± 0.16 nsec for the 263.2 keV level. Author (NSA)

N69-33880# Los Alamos Scientific Lab., N. Mex.
COMPTON SCATTERING FACTORS FOR ASPHERICAL FREE ATOMS
Don T. Cromer 15 Apr. 1969 242 p refs
(Contract W-7405-ENG-36)
(LA-4079) Avail: CFSTI

Incoherent scattering factors for all aspherical free atoms were computed from numerical SCF Hartree–Fock wave functions. The complete Waller–Hartree theory with all exchange terms was used. Author (NSA)

N69-33885# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SHOWER EFFICIENCY OF SPARK CHAMBERS
B. Z. Kopeliovich, A. F. Pisarev, A. I. Saraikin, and V. M. Sheshunov 1969 15 p refs In RUSSIAN
(JINR-P13-4369) Avail: AEC Depository Libraries

The shower efficiency of spark chambers, having the dimensions 135×145 cm^2 with the gap from 1 to 5 cm, is experimentally investigated. The minimum gap, at which high shower efficiency is conserved, is in the range between 1.5 and 2 cm. The efficiency of the chambers (with 2 cm gap) for simultaneous detection of 1–8 particles, depending on the magnitude of a clearing field and the momentum delay time, is studied in detail. Author (NSA)

N69-33889# Stanford Linear Accelerator Center, Calif.
TWO-MILE ACCELERATOR PROJECT Quarterly Status Report, 1 Oct. –31 Dec. 1968
Mar. 1969 67 p refs
(Contracts AT(04-3)-400; AT(04-3)-515)
(SLAC-98) Avail: CFSTI

A status report on the Stanford Linear Accelerator Project covering the period October 1, 1968 to December 31, 1968 is presented. Topics included are accelerator and research area operations, accelerator and research area equipment development, and physics research equipment development. Author (NSA)

N69-33890# Idaho Nuclear Corp., Idaho Falls. Nuclear and Chemical Technology Div.
CALCULATED NORMAL FREQUENCIES AND NEUTRON SCATTERING LAW FOR BENZENE
R. S. Marsden Mar. 1969 62 p refs
(Contract AT(10-1)-1230)
(IN-1269) Avail: CFSTI

The first set gives good agreement with the assigned frequencies of Crawford and Miller for the planar vibrations and of Herzberg for the nonplanar vibrations. The second set gives good agreement with the frequency assignments of Shimanouchi. These normal modes and frequencies were then used to calculate the slow neutron scattering properties of a free gas of benzene molecules. The scattering law, which presents the double differential cross section in terms of the energy and the momentum changes, was calculated for each set of frequencies and modes. Therefore, for the other scattering properties only the Crawford and Miller–Herzberg assignments were used. The calculated values of the total cross section are in good agreement with measured values. Calculated values of the average cosine of the scattering angle and of the diffusion coefficient are somewhat higher than values deduced directly from measured cross sections. A thermal neutron spectrum and pulsed neutron parameters calculated from the scattering law agree fairly well with measurements. Author (NSA)

N69-33891# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
DOUBLE TIME-OF-FLIGHT SPECTROMETER WITH MULTIPARAMETRIC ANALYSIS [SPECTROMETRE A DOUBLE TEMPS-DE-VOL AVEC ANALYSE MULTIPARAMETRIQUE]
C. Perrin, R. Bouchez, P. Quivy, J. C. Gondrand, A. Giorni et al May 1968 8 p refs In FRENCH; ENGLISH summary Presented at the Colloq. sur les Methodes Expti. en Phys. Nucl. et Phys. des Particules, Strasbourg, 4–6 Dec. 1968
(CEA-CONF-1250; TN-PhN-68/C-5T) Avail: AEC Depository Libraries

The three nucleon reactions D(n,nnp) has been studied at 14 MeV using an automatic system for collection of data (≈1 true event by minute, ≈10^4 events total). For each event seven parameters were recorded on paper tape. The nn and np interaction parameters were obtained by analysis off-line on an IBM 7044 computer. Author (NSA)

N69-33912# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
INELASTIC ELECTRON PROTON SCATTERING AT FIXED FOUR MOMENTUM TRANSFER OF 0.773 AND 1.938 (GeV/c) SUP 2
W. Albrecht, F. W. Brasse, H. Dorner, W. Flauger, K. Frank et al Feb. 1969 26 p refs
(DESY-69/7) Avail: AEC Depository Libraries

Inelastic e-p scattering measurements were performed at fixed four-momentum transfers of q^2 = 0.773 and 1.935 $(GeV/c)^2$ and at scattering angles of ϑ = 47.8° and 76.0° using the internal beam of the DESY electron synchrotron. Only the scattered electron was detecteded. The measured spectra ranged from pion threshold up to a missing mass of 3 GeV at ϑ = 47.8° and up to 2.6 GeV at ϑ = 76°. The results are compared with predictions for inelastic e-p scattering. Author (NSA)

N69-33989# Cambridge Electron Accelerator, Mass.
SEMIANNUAL REPORT, 1 JUL. –31 DEC. 1968
12 Feb. 1969 56 p refs
(Contract AT(30-1)-2076)
(CEAL-1047) Avail: CFSTI

The semi-annual report is presented in seven parts. Part 1 indicates the purpose of the contract, which is concerned with the operation of the 6-GeV Cambridge Electron Accelerator, and lists the main guiding committees. Part 2, on accelerator operation, shows that the total number of prime-user hours and parasite-user hours of accelerator operation in the six-month period was 2590. Part 3 describes the 25 experiments underway or in preparation. Part 4 summarizes progress on the colliding beam facility (Project Bypass). Part 5 summarizes major improvements and new projects. Part 6 deals with safety. Part 7 lists the major publications. NSA

N69-33983# Central Electricity Generating Board, Berkeley (England) Nuclear Labs.
PROMPT NEUTRON DECAY CONSTANT MEASUREMENTS IN URANIUM DIOXIDE-GRAPHITE CAGR TYPE ASSEMBLIES. PART 2: REFLECTED STACKS

P. J. Ballard, R. H. Waterson, and J. D. Young Jan. 1968 33 p refs Submitted for publication
(RD/B/N982) Avail: CFSTI

Prompt neutron decay constants and boron trifluoride reaction rate distributions have been measured on a range of graphite reflected stacks and compared with those determined theoretically from ARGOSY/CRAM using the $^1/_\nu$ poison removal method. The graphite moderated stacks were built on a 15.9 in. square lattice with uranium oxide fuel. They ranged in k_{eff} from 0.56 to 0.94 and the reflector thickness varied from a few inches to several feet. The results of the comparison indicate that the ARGOSY/many mesh point CRAM handling of the reflector calculation over-estimated the worth of the reflector by 6.9 ± 2.6%. Author

N69-33998# Massachusetts Inst. of Tech., Cambrige. Research Lab. of Electronics.
HIGH PRECISION G-FACTOR DETERMINATIONS Final Technical Report, 1 Feb. 1968–31 Jan. 1969
Daniel Kleppner Apr. 1969 18 p refs
(Contract N00014-67-A-0204)
(AD-687522) Avail: CFSTI CSCL 20/8

The work is concerned with atomic structure and the interaction between atoms. Also involved are applications of superconductivity to problems in atomic physics and to problems of energy detection. Experiments have been carried out to determine the triplet and singlet potentials between atoms by measuring differential scattering cross sections with a spin-selected atomic beam. Reported here are the results of a series of experiments to measure the triplet potential for various alkali-alkali systems. TAB

N69-34006# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
FORM FACTORS AND TOTAL CROSS SECTIONS OF WEAK AND ELECTROMAGNETIC INTERACTIONS
M. A. Markov 1969 9 p refs Presented at the CERN-JINR Seminar on the Perspectives in High Energy Phys., Riga, Jun. 1967
(JINR-E2-4370; CONF-670660-1) Avail: AEC Depository Libraries

A hypothesis is discussed that the total cross sections may approach in their magnitude and energy dependence the corresponding cross section of weak (or electromagnetic) processes calculated under the assumption of point particles. Author (NSA)

N69-34007# Syracuse Univ., N.Y. Dept. of Physics.
NON-PERTURBATION APPROACH FOR DECAY PROBLEMS
Kunio Yamamoto Jan. 1969 11 p refs Supported by AEC
(SU-1206-190; NYO-3399-190) Avail: CFSTI

A nonperturbation approach for decay problems is presented. The results may be applicable to strong interaction decays provided that the width is sufficiently small. For weak interaction decays, including that of the neutral kaon, all the results are identical with those of perturbation theory. Some discussion is given of the difference between the resonances (decay through strong interaction) and the unstable particles (decay through weak interaction). Author (NSA)

N69-34030# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
INTERACTION CROSS SECTIONS OF NUCLEONS WITH HELIUM
V. S. Bareshenkov and S. M. Eliseev 1969 7 p refs In RUSSIAN
(JINR-P2-4333) Avail: AEC Depository Libraries

The energy dependence curves of cross sections σ_t, σ_{in} σ_{el} for the interaction of a nucleon with the ^{4}He nucleus are given. At higher energies the curves were calculated by the Glauber theory, while for the lower energies they were obtained by interpolation of known experimental data by means of optical model formulas. Author (NSA)

N69-34040# Scientific Research Atomic Reactor Inst., Melekess (USSR).
AN ANALYSIS OF THE NONSTATIONARY KINETIC EQUATION OF NEUTRON TRANSPORT IN MODERATING AND MULTIPLYING MEDIA
S. R. Shikhov and A. A. Shkurpelov 1968 80 p refs In RUSSIAN
(SRARI-P-22) Avail: AEC Depository Libraries

The nonstationary process of neutron transport in a substance taking into account the dependence of the macroscopic cross sections upon energy and coordinates is considered. The spectral analysis of the neutron transport operator and the semi-group generated by it was carried out. Conditions at which the neutron transport operator has its real eigenvalue were obtained. The asymptotic behavior of the solution of the nonstationary equation was determined. Author (NSA)

N69-34046# Joint Inst. for Nuclear Physics, Dubna (USSR). Lab. of Nuclear Reactions.
ESTIMATE OF THE PRODUCTION CROSS SECTION OF TRANSURANIC ELEMENTS IN THE REACTION OF NUCLEI FISSION BY ACCELERATED Xe AND U IONS
S. A. Karamyan and Yu. Ts. Oganesyan 1969 18 p refs In RUSSIAN
(JINR-P7-4339) Avail: AEC Depository Libraries

An extrapolation calculation of the production cross sections of the ^{294}110 and ^{298}114 isotopes in the reactions U(U,f),U(Xe,f) was made. The obtained cross sections are situated at the level $(10^{-29}–10^{-30})$ cm^2. Production cross sections were also calculated for different actinide (from Th to Fm) isotopes in the reaction U(Xe,f). A number of approximations on the process of the two heavy nuclei fusion and fission of superheavy compound-nucleus were the basis of the calculation. The stability of the results to the change of these assumptions is discussed. Author (NSA)

N69-34047# Joint Inst. for Nuclear Physics, Dubna (USSR). Lab. of Nuclear Problems.
THE FAST He 3 NUCLEUS PRODUCTION ON LIGHT NUCLEI UNDER 665 MeV PROTON BEAM BOMBARDMENT
V. I. Komarov, G. E. Kosarev, and O. V. Savchenko 1969 19 p refs In RUSSIAN; ENGLISH summary
(JINR-P1-4373) Avail: AEC Depository Libraries

The cross sections for knocking out fast 530 MeV ^{3}He-nuclei from ^{6}Li, ^{9}Be, ^{12}C target at 5.4° to the 665 MeV proton beam were measured. The peak in the high energy part of the ^{3}He momentum spectrum was observed which is due to the quasielastic scattering (QES) of protons on three nucleon clusters in the investigated nuclei. The cross sections of such scattering causing the ^{3}He knockout from ^{6}Li, ^{9}Be (and the upper limit for ^{12}C, ^{16}O) were evaluated. Also the differential cross section of elastic scattering (ES) of protons on free ^{3}He nuclei ($\Theta = 169°$ cms, $q = 8.8$ fm^{-1}) was measured. These measurements were performed as a part of the program of experimental investigations of high-energy proton interactions with nuclei resulting in the high momentum transfer to a few nucleon system without its disintegration. QES of protons by the two nucleon clusters in light nuclei accompanied by the fast deuteron knocking out for the first time was observed in the experiments and more completely was investigated recently. Author (NSA)

N69-34067# Gulf General Atomic, San Diego, Calif.
INTEGRAL NEUTRON THERMALIZATION Annual Summary Report, 1 Oct. 1967 – 30 Sep. 1968
J. R. Brewster, G. M. Borgonovi, T. Gozani, D. H. Houston, J. U. Koppel et al 30 Oct. 1968 94 p refs
(Contract AT(04-3)-167)
(GA-9036) Avail: CFSTI

Work carried out on the Integral Neutron Thermalization Program of Gulf General Atomic, Inc. in the period Oct. 1, 1967 to Sept. 30, 1968 is described. The studies included neutron thermalization in light and heavy water, diphenyl, polyethylene, beryllium, beryllium oxide, uranium dicarbide, uranium dioxide, and zirconium hydride as well as spectral studies in ^{235}U and ^{238}U spheres. NSA

N69-34068# Los Alamos Scientific Lab., N.Mex.
NEUTRON AND GAMMA RADIATIONS FROM PURE Pu 238
J. Bubernak, G. M. Matlack, and C. F. Metz [1968] 4 p refs Presented at Intern. Conf. on the Constructive uses of At. Energy, Washington, D.C.
(Contract W-7405-eng-36)
(LA-DC-9763; CONF-681101-19) Avail: CFSTI

The neutron activity of ^{238}Pu was measured for high-purity Pu metal and for oxide and nitride compounds of Pu using a water-moderated BF_3 detector. High-resolution spectra were measured for the metal, and oxide, nitride, and fluoride compounds. NSA

N69-34072# Stanford Univ., Calif. High Energy Physics Lab.
SPIN-SPIN EFFECT IN THE Ho 165 TOTAL NEUTRON CROSS SECTION AT ENERGIES OF 0.4 AND 1.0 MeV
T. R. Fisher, D. C. Healey, and J. S. Mc Carthy Mar. 1969 32 p refs Submitted for publication
(Contract Nonr-225(67))
(AD-687712; SU-HEPL-594) Avail: CFSTI CSCL 20/8

Several recent attempts have been made to observe a change in the total neutron cross section of 165Ho resulting from the reversal of the relative orientations of the neutron and 165Ho spins. The paper reports measurements of the spin correlation effect, or spin-spin effect, at the neutron energies 0.4 and 1.0 Mev. The results of new calculations for the spin-spin effect for neutron energies less than 8 Mev are also presented. TAB

N69-34078# European Organization for Nuclear Research, Geneva (Switzerland).
PROGRAM OF EXPERIMENTAL STUDIES WITH THE NEW SERPUKHOV ACCELERATOR
R. M. Sulyaev Jan. 1969 12 p Transl. into ENGLISH from Vestn. Akad. Nauk SSR (Moscow), v. 38, no. 8, Aug. 1968 p 76–81 in FRENCH
(CERN-trans-69-3) Avail: AEC Depository Libraries

The various experimental studies which can be performed using the Serpukhov accelerator include the behavior of certain physical dimensions at increased energies, study of the internal properties of interactions and decays, treatment of the properties of particles having high energies in the study of properties of matter at small space – time intervals, the structure of elementary particles, and neutrino physics. Experiments using the internal proton beam include proton – proton scattering, and the Dirac monopole. Also meson (π), meson (K), and antiproton interactions can be studied. Author (NSA)

N69-34081# Bettis Atomic Power Lab., Pittsburgh, Pa.
EMPIR: A PROGRAM TO SOLVE THE MULTI-GROUP SLAB TRANSPORT PROBLEM USING THE ENDF/B LIBRARY
J. D. Butler, E. M. Gelbard, and E. Schmidt Mar. 1969 38 p refs
(Contract AT(11-1)-gen-14)
(WAPD-TM-822) Avail: CFSTI

The EMPIR (BE22) solves the neutron transport problem with slowing down in slab geometry by using the ENDF/B library for all material cross sections of interest. The slowing down description is provided by a matrix formulation of scattering coefficients, while the spatial solutions for the flux in each group are obtained from a discrete ordinate approximation. Program BD03 is a related special program to obtain fine detail spectra for simply buckled media. Author (NSA)

N69-34088# Aktiebolaget Atomenergi, Stockholm (Sweden).
NEUTRON PHYSICS LABORATORY Annual Progress Report, 1 Oct. 1967 – 30 Sep. 1968
T. Wiedling Apr. 1969 33 p refs
(AE-354) Avail: CFSTI

The present progress report gives some short descriptions of experiments going on in the neutron physics branch at the Studsvik laboratories. The main program concerns fast neutron physics at the Van de Graaff laboratory with a strong emphasis on neutron scattering cross section data of elements of interest for reactor calculations. Since the Van de Graaff accelerator is still the one in Sweden giving the highest potential, it has been quite natural to use the machine also for some nuclear physics experiments with charged particles, though in some cases related to the neutron physics program. In connection with the use of the reactors at Studsvik for physics experiments, research programs have been in progress for several years concerning the use of reactor neutrons for production of isotopes for a systematic study of short lived nuclear isomeric states as well as for the study of the gamma emission in the fission process. Author (ESRO)

N69-34107# California Inst. of Tech., Pasadena.
ANGLE IN WEAK INTERACTIONS
N. Cabibbo Jan. 1969 13 p Presented at Conf. on Fundamental Interactions at High-Energy, Coral Gables, Fla., 22-24 Jan. 1969
(Contracts F61052-67-C-0084; AT(11-1)-68)
(CALT-68-186; CONF-690110-1) Avail: CFSTI

Some recent work is reported on the problem of determining the weak interaction angle by imposing a self-consistency condition on weak, strong, and electromagnetic forces. NSA

N69-34113# California Inst. of Tech., Pasadena, Calif.
CERTAIN THEORIES OF CP VIOLATION
Murray Gell-Man Jan. 1969 10 p Presented at Conf. on Fundamental Interactions at High-Energy, Coral Gables, Fla., 22 – 24 Jan. 1969
(Contract AT(11-1)-68)
(CALT-68-187; CONF-690110-2) Avail: CFSTI

Attempts to explain CP violation are classified into three classes of theories. Theories of fairly large CP violation at moderate energies are classified into two types – where large CP violating effects are restricted to reactions involving certain new particles and where large CP violating effects occur in reactions involving familiar reactions. A few possibilities which concern the hypothetical intermediate vector boson for weak interactions, which might be connected with CP violations in theories of these types are discussed. NSA

N69-34120# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
COMPTON SCATTERING OF PHOTONS BY BOUND K-SHELL ELECTRONS
M. Gavrila Mar. 1969 10 p refs
(IFA-FT-74) Avail: AEC Depository Libraries

The nonrelativistic matrix element for Compton scattering by bound K-shell electrons, with retardation included, is evaluated analytically exactly in terms of hypergeometric functions of Lauricella's type F_D. This is done by expressing the matrix element with the help of the Coulomb Green's function in momentum space, for which the integral representation of Schwinger is used. In the dipole approximation the matrix element reduces to essentially three hypergeometric Appell functions. Author (NSA)

N69-34123# Louvain Univ. (Belgium).
BOSONS AND FERMIONS [BOSONEN EN FERMIONEN]
A. Verbeure Jan. 1969 87 p refs In FLEMISH
Avail: CFSTI

A unified study is made of the quasi-free conditions of bosons and fermions using algebraic techniques rather than classical quantization techniques. The conditions of a system are analyzed whose element ψ is an observable Hermitian operator A in a separable Hilbert space H. The physically measurable quantities are the expected values of the observable on the various conditions. The divergence problem of such a system when applied in elementary particle physics and statistical mechanics is pointed out. Algebraic methods of canonical commutation relations and canonical anticommutation relations as well as their automorphisms are examined. Mathematical results are derived for the introduction of a complex structure in a real space. The quasi-free and clean conditions of bosons and fermions are then studied. Finally, the explicit representation defined by all quasi-free conditions is demonstrated for bosons and fermions. Transl. by K.W.

N69-34125# California Univ., San Diego. Dept. of Physics.
PROTON-PROTON BREMSSTRAHLUNG
Thompson Humphrey Burnett 1968 76 p refs
(Contract AT(11-1)-GEN-10)
(UCSD-10P10-57) Avail: CFSTI

A covariant formulation of nucleon–nucleon bremsstrahlung is presented which is unitary, gauge invariant and has a relatively simple form in the soft-photon limit. Applying the soft-photon approximation to experiment, a large discrepancy is found with noncoplanar data taken in the Harvard geometry, while the fit for the coplanar case is good. The inclusion of nonsoft-photon dynamics using S-matrix methods is discussed. Author (NSA)

N69-34137# Uppsala Univ. (Sweden). Quantum Chemistry Group.
QUANTUM THEORY OF MANY-PARTICLE SYSTEMS Final Scientific Report, 1 Sep. 1967–31 Aug. 1968
Per Olov Lowdin 13 Mar. 1969 19 p refs
(Grant AF-EOAR-50-67)
(AD-687493; AFOSR-69-050TR) Avail: CFSTI CSCL 7/4

The report gives a survey of the research work in the quantum theory of matter carried out by the Uppsala Quantum Chemistry Group during the period 1 September 1967 - 31 August 1968. The contents of 21 Preliminary Research Reports and 18 published papers is briefly reviewed. Author (TAB)

N69-34138# Commissariat à l'Energie Atomique, Paris (France).
STUDIES ON FISSION PRODUCTS [ETUDE SUR LES PRODUITS DE FISSION]
Denis Breton May 1969 20 p refs In FRENCH; ENGLISH summary
(CEA-BIB-146) Avail: CFSTI

After a bibliographical review of the theories predicting the nature (characterized by the numbers A and Z) of the products formed immediately after fission, a model established by Benzi is developed for calculating the capture cross-sections σ (n,γ). The determination of the parameters required for evaluating cross-sections is also considered. Author (ESRO)

N69-34139# Rome Univ. (Italy). Inst. of Physics.
LOW ENERGY ANTIPROTON-PROTON ANNIHILATION INTO POSITIVE PION-NEGATIVE PION AND POSITIVE KAON-NEGATIVE KAON
R. Bizzari, E. Castelli (Trieste Univ.), P. Guidoni, F. Marzano, G. C. Moneti et al 14 Mar. 1969 12 p refs *Its* Nota Interna 213
Avail: CFSTI

The 117 antiproton proton decay to positive and negative pion events and 37 antiproton proton decay to positive and negative kaon events with antiproton momenta between 200 and 600 MeV/c were measured. The negative pion angular distribution has a striking forward peaking which increases with decreasing antiproton momentum. Author (ESRO)

N69-34154# Isotopes, Inc., Westwood, N.J.
FISSION CHAIN ANALYSIS TABLES FOR ODD MASS VALUES A GREATER THAN OR EQUAL TO 75 BUT LESS THAN OR EQUAL TO 155
Peter Alexander 1 Apr. 1969 518 p refs
(Contract DA-01-69-C-0057)
(AD-687327) Avail: CFSTI CSCL 18/8

Established values for the decay linkages, half lives and branching ratios pertinent to a number of odd-A mass chains have been employed in a computer calculation. The time varying interdependent population of each member of the mass chain has been computed for all odd-A chains with $75 = \text{or} < A = \text{or} < 155$. Tables containing population values computed at appropriate intervals over the period 0 - 1.8 years are presented. An initial normalized population of 1.0 is assumed to be distributed to the first member of each of the odd mass chains having $75 = \text{or} < A = \text{or} < 83$, $107 = \text{or} < A = \text{or} < 127$ and $145 = \text{or} < A = \text{or} < 155$. Additional tables are presented for those odd mass chains covering the two peaks of the fission curve ($85 = \text{or} < A = \text{or} < 105$ and $129 = \text{or} < A = \text{or} < 143$). Calculations for these mass numbers assume an initial population of 1.0 placed consecutively in each member of the mass chain. Graphical plots of these population interrelationships are also presented. The above results are obtained by solution of the differential equations describing the populations in each mass chain, taking into account all known branching and cross linkages. Author (TAB)

N69-34155# Atomic Energy Establishment, Winfrith (England).
MEASUREMENT OF DEPLETION OF NOMINALLY 0.04 PERCENT DEPLETED URANIUM METAL FOIL BY TWO DIFFERENT METHODS
R. A. Millington, W. H. Taylor, and P. J. Webber Feb. 1968 9 p ref
(AEEW-M-807) Avail: CFSTI

A depleted uranium foil sandwiched between similar foils is irradiated in a pure thermal spectrum together with a similar pack of natural uranium foils. The relative activity induced is then measured by gamma spectrometry. In a second method, two platinum discs with very thin deposits of depleted and natural

uranium are mounted in either side of a back-to-back double fission chamber, which is then irradiated in a thermal column. Measurements on the same material by the two methods showed agreement to better than 1%. NSA

N69-34162# Rome Univ. (Italy). Inst. of Physics.
A MEASUREMENT OF NEUTRAL AND CHARGED PION FORM FACTOR SLOPES
E. Di Capua, A. Lanzara, S. Devons (Columbia Univ.), P. Nemethy and S. Nissim-Sabat (Columbia Univ.) 8 Jan. 1969 30 p refs Submitted for publication Sponsored in part by Office of Naval Res. *Its* Nota Interna 202
Avail: CFSTI

In an experiment performed at Columbia University's Nevis Cyclotron neutral and negative pion reactions were studied. Using a system of counters and spark chambers pairs with an opening angle near 120° were selected and the invariant mass spectrum of the pairs in 2200 π^0 decays and in 400 radiative captures were analyzed. The charged pion form factor slope for time-like momentum transfers was calculated. Author (ESRO)

N69-34172# Technische Hochschule, Munchen (West Germany). Inst. Fuer Technische Elektronik.
INVESTIGATION OF TEMPERATURE, PRESSURE, AND RADIATION RESISTANT SEMICONDUCTOR PROBES FOR REACTOR IN-CORE APPLICATION [UNTERSUCHUNGEN AN BESONDERS WAERME-, DRUCK-UND STRAHLUNGS RESISTENTEN FESTKOERPERDETEKTOREN FUER DIE IN DER REAKTOR-MESS- UND REGELUNGSTECHNIK STAUFTRETENDEN STRAHLENFLUESSE]
J. Graul and I. Ruge Feb. 1969 52 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-69-6) Avail: AEC Depository Libraries

Semiconductor materials which meet the requirements for reactor in-core application are discussed. The radioactivity due to nuclear transmutation in these materials is calculated as are the number of Frenkel defects which may be expected from neutron, gamma, and alpha irradiation. For silicon carbide, at present one of the most promising semiconductor materials for reactor application, there is given a short review of preparation techniques, electrical properties, doping and etching processes. Radiation-induced currents in silicon carbide pn junctions are examined experimentally and theoretically. Suggestions are made for the development of a radiation-resistant neutron probe using polycrystalline silicon carbide Schottky barriers covered by a double layer of boron and iridium for neutron-α particle conversion. The signal amplitude induced by reactor neutron flux in such a probe is estimated. Author (NSA)

N69-34173# Brookhaven National Lab., Upton, N.Y.
THE 30 MeV THREE-STAGE VAN DE GRAAFF FACILITY AND ITS ASSOCIATED RESEARCH PROGRAM AT BROOKHAVEN NATIONAL LABORATORY
H. E. Wegner 1969 19 p refs Presented at the 14th Ann. Natl. Conf. on Nucl. Spectry. Struct. of the Atomic Nucleus, Yerevan (USSR), 27 Jan.–4 Feb. 1969 Sponsored by AEC
(BNL-13479; CONF-690115-1) Avail: CFSTI

Design and development of the 30-MeV three-stage Van de Graaff accelerator and experimental facilities are discussed. The flexibility in the arrangement of accelerators and design of the building structure allow the accelerators to be used in two different acceleration modes and to accelerate unusual particles like tritium and helium-6. Author (NSA)

N69-34176# Battelle Memorial Inst., Columbus, Ohio.
EVALUATION OF THE APPLICABILITY OF EXISTING DATA TO THE ANALYTICAL DESCRIPTION OF A NUCLEAR-REACTOR ACCIDENT Quarterly Progress Report, Jan.–Mar. 1969
David L. Morrison, Wayne A. Carbiener, and Robert L. Ritzman Apr. 1969 44 p refs
(Contract W-7405-eng-92)
(BMI-1861) Avail: CFSTI

Long term core recovery cooling requirements are discussed; cooling requirements for crumbled cores in BWR systems are defined. Heat transfer and pressure drop equations are given for an isolated crumbled fuel mass; effects of slip ratio on the gravitational head are considered. Crumbled fuel height is shown as a function of coolant exit quality and power level. The mathematical model for forced convection cooling of a partially crumbled core is given; equations for heat balance between the fission product decay heat and the coolant enthalpy change are included. Pressure drop, power level, and boiling effects on coolant evaporation are evaluated. The formulation of a physical model for determining fuel cladding behavior under coolant loss accidents is described. Fission product chemical groups are tabulated; fission products are ranked according to relative hazard. Heat transfer data for core emergency cooling are compared; cooldown rates and heat transfer coefficients are shown as a function of fuel assembly height. 25 references. Author (NSA)

N69-34181# Princeton Univ., N.J.
HIGH ACCURACY, MANY-ELECTRON WAVEFUNCTIONS FOR NOBLE GAS MOLECULES Progress Report, 1 Nov. 1967–31 Oct. 1968
Leland C. Allen 9 Apr. 1969 8 p refs
(Contract AT(30-1)-3532)
(NYO-3532-8) Avail: CFSTI

A computer program was developed for carrying out rigorous, ab initio, many-electron molecular orbital, molecular orbital plus configuration interaction, and valence bond electronic wavefunctions. Studies were made on argon atom orbitals and repulsive energy surfaces. NSA

N69-34182# Kernforschungszentrum, Karlsruhe (West Germany). Zyklotron-Laboratorium.
GAMMA TRANSITIONS AND EXCITED STATES OF NEUTRON-DEFICIENT EVEN LEAD NUCLEI INVESTIGATED BY DECAY OF BISMUTH NUCLEI [GAMMA-UBERGARGE UND ANREGUNGSZUSTANDE NEUTRONENARMER GERADER BLEIKERNE, UNTERSUCHT AM ZERFALL VON WISMUTKERNEN]
A. Hanser Dec. 1968 65 p refs In GERMAN
(KFK-876) Avail: AEC Depository Libraries

Gamma transition energies, relative gamma intensities, K conversion coefficients, and K/L conversion ratios were measured for the decay of the nuclei ^{202}Bi(1.6 h), ^{200}Bi (36 min), and ^{198}Bi (12 using semiconductor detectors. Coincidence relations of sufficiently strong transitions were investigated with NaI(Tl) detectors. The observed transitions were assigned, as far as possible, to the level schemes of the daughter nuclei ^{202}Pb, ^{200}Pb, and ^{198}Pb. The investigated Bi nuclides were produced through irradiation of Pb (enriched in ^{204}Pb) with 52-MeV deuterons or Tl with 104-MeV alpha particles and isolated by subsequent electromagnetic and chemical separation. Author (NSA)

N69-34183# Argonne National Lab., Ill. AUA-ANL Summer Engineering Practice School.
A TECHNICAL AND ECONOMIC EVALUATION OF NEUTRON SOURCES FOR THERMAL NEUTRON RADIOGRAPHY

Cyril F.Krolick (Maryland Univ.), Dean Katerndahl (Northwestern Univ.), and Ronald Voll (Illinois Univ.) 2 Aug. 1968 62 p refs
(TID-25050) Avail: CFSTI

A technical and economic analysis of a variety of nonreactor neutron sources for thermal neutron radiography applications is presented. Included also is a listing of the characteristics of thermal nuclear reactors which have been used for neutron radiography. The study shows that at the present time, there are no neutron sources which can provide the quantities of neutrons that are available from reactors. The development of spontaneous fissioning isotopes, however, and sealed-tube neutron generators may provide very attractive sources in certain circumstances. Also, for continuous fluxes, where slightly less intensity than that available from a reactor can be utilized, a 1 to 3 MeV Van de Graaff utilizing the deuterium-beryllium reaction appears attractive.
Author (NSA)

N69-34184# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
ELASTIC NEUTRON SCATTERING BY MEDIUM AND HEAVY NUCLEI IN THE ENERGY RANGE 1 TO 40 KeV
Yu. A. Aleksandrov and G. S. Samosvat 1969 34 p refs In RUSSIAN; ENGLISH summary
(JINR-P3-4354) Avail: AEC Depository Libraries

The technique and the measurement results of the angular distributions of 1 to 40 keV neutrons, scattered by the Sr, Mo, Rh, Cd, Sn, Sb, Te, I, La, Pb and Th nuclei are described. The method of obtaining the relative averaged differential scattering cross sections from the observed angular distributions of neutrons emitted from thick scatterers, is expounded. It is shown that for each element all the obtained information can be described by one parameter ω_1/E, where ω_1 is the coefficient for the first polynomial in the cross section expansion in the Legendre polynomials, and is the neutron energy. The contribution of the compound nucleus into the value ω_1 is analyzed and is shown to be small. The experimental results are compared with the calculations performed by the optical model of the nucleus, where good qualitative agreement is obtained by potentials describing other data on the neutron interaction with the nuclei. The results for La separate out of the whole picture for the coefficient ω_1 behavior with the change of neutron energies.
Author (NSA)

N69-34185# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
COHERENT SCATTERING OF SLOW NEUTRONS BY LIQUID LEAD
V. V. Golikov and Zh. A. Kozlov 1969 38 p refs In RUSSIAN
(JINR-P14-4355) Avail: AEC Depository Libraries

The results of the measurements of the slow neutron coherent scattering by solid and liquid lead in a wide range of momentum transfers performed on the installations at the pulsed reactor IBR by the time-of-flight method are reported. The data obtained indicate that two types of collective excitations characterized by dispersion relations analogous to the rules of the dispersion of the crystal longitudinal and transversal oscillations are present in liquid lead. The experimental results are compared with the polycrystal liquid model and with the hydrodynamic model, which takes account of the dependence of kinetic coefficient on frequency. The limits of the applicability of these models are discussed.
Author (NSA)

N69-34186# Vsesoyuznyi Nauchno-Issledovatelskii Institut Radiatsionnoi Tekhniki, Moscow (USSR).
ACTIVATION DETERMINATION OF INDIUM, SELENIUM, FLUORINE, AND OTHER ELEMENTS IN A STREAM OF SOLUTIONS [AKTIVATSIONNOE OPREDELENIE INDIYA, SELENA, FTORA I DRUGIKH ELEMENTOV V POTOKE RASTVOROV]
E. R. Kartashev and A. S. Shtan 1968 18 p refs In RUSSIAN
(VNIIRT-2) Avail: AEC Depository Libraries

The design of the installation and procedures are described for continuous automatic neutron activation with a $^{239}Pu-Be$ source ($\approx 5 \times 10^6$ neutron/sec). A scintillation counter with a 80 × 80 mm NaI(Tl) crystal and a complex of recording instruments were also used for determining In, V, Mn, Se, Al, and F in solutions. Experimental data obtained on the thresholds of neutron activation determination of the elements in solutions forming ^{116m}In, ^{52}V, ^{56}Mn, ^{77m}Se, ^{28}Al, and ^{16}N are tabulated.
NSA

N69-34188# Kernforschungszentrum, Karlsruhe (West Germany).
ELASTIC SCATTERING OF 104 MeV ALPHA PARTICLES
G. Hauser, R. Loehken, H. Rebel, G. Schatz, G. W. Schweimer et al Dec. 1968 67 p refs
(KFK-871) Avail: AEC Depository Libraries

The differential elastic scattering cross sections were measured for the scattering of 104-MeV alpha particles on ^6Li, ^9Be, ^{12}C, ^{14}N, ^{16}O, ^{20}Ne, ^{40}Ar, ^{64}Ni, ^{90}Zr, ^{124}Sn, ^{208}Pb, and ^{209}Bi. All angular distributions show a pronounced diffraction pattern. The cross section data were analyzed in terms of parameterized phase-shift functions and in terms of the spinless optical model. Good fits were obtained. A strong absorption was found for the heavy nuclei, $A \geq 124$. For these nuclei, only the outermost region of the nuclear surface contributes to the scattering. The absorption is not so strong for the medium weight nuclei, $20 \leq A \leq 90$. Information about the nuclear surface can be extracted from the differential cross section. The well-known phase ambiguity in the optical model was found for these nuclei. For the light nuclei ($A \leq 16$) the inner region of the interaction potential contributes to the scattering. The phase-shift analysis leads to good fits, but the phase shifts obtained differ significantly from those of the optical model analysis.
Author (NSA)

N69-34189# Aktiebolaget Atomenenergi, Stockholm (Sweden).
THE DECAY OF Os191
S. G. Malmskog and A. Bäcklin Mar. 1969 25 p refs
(AE-352) Avail: CFSTI

Gamma ray and conversion electron energies and intensities for transitions in ^{191}Ir have been measured in the decay of ^{191}Os using a Ge(Li) detector and a double focusing beta spectrometer. The following energies (in keV) and transition multipolarities were found: 41.92 ± 0.02(E3), 47.05 ± 0.03(E2), 82.46 ± 0.04 (56% M1 + 44% E2) and 129.52 ± 0.02 (88% M1 + 12% E2). From a delayed coincidence measurement the half-life of the 129.52 keV level in ^{191}Ir was found to be $(1.26 \pm 0.11) \times 10^{-10}$ sec.
Author (ESRO)

N69-34190# Aktiebolaget Atomenergi, Stockholm (Sweden).
DIFFUSION FROM A GROUND LEVEL POINT SOURCE EXPERIMENT WITH THERMOLUMINESCENCE DOSIMETERS AND Kr 85 TRACER SUBSTANCE
Ch. Gyllander, S. Hollman, and U. Widemo Apr. 1969 24 p refs
(AE-353) Avail: CFSTI

Within the framework of the IRIS-project (Iodine Research in Safety Project) an experiment to study diffusion at near-ground level was carried out on 19th December 1967 using Kr^{85} as the tracer element. The object of the experiment was a) to test the method using β-sensitive thermoluminescence dosimeters under actual field conditions; b) to study the initial dilution from a ground level point source. At each level various dispersion parameters have been experimentally determined and their conformity to normal distribution has been calculated. Dilution factors valid for the centre of the plume are related to the values reported in the literature.
Author (ESRO)

N69-34195# California Inst. of Tech., Pasadena.
LOW-ENERGY, HIGH RESOLUTION, VARIABLE ANGLE ELECTRON IMPACT SPECTROSCOPY, VOLUME 1
James Kinsey Rice (Ph.D. Thesis) 1969 246 p refs Supported in part by AEC
(CALT-532-39-Vol-1) Avail: CFSTI

The design, construction, operation, and performance of a low-energy, variable-angle, high-resolution, electron-impact spectrometer are described. A brief historical review of the experimental development of electron scattering is presented. Relevant aspects of scattering theory are reviewed. The Ochkur–Rudge approximation is applied to calculation of the exchange excitation of ethylene ($X\,^1A_g \rightarrow a\,^3B_{1u}$) by electron impact. NSA

N69-34196# California Inst. of Tech., Pasadena.
LOW ENERGY, HIGH RESOLUTION, VARIABLE ANGLE ELECTRON IMPACT SPECTROSCOPY, VOLUME 2
James Kinsey Rice (Ph.D. Thesis) 1969 490 p refs Supported in part by AEC
(CALT-532-39-Vol-2) Avail: CFSTI

A low-energy, variable-angle, high-resolution, electron-impact spectrometer described in CALT-532-39(Vol. 1) was used to measure the differential scattering cross sections for the electron-impact excitation of helium and five molecules (N_2, CO, H_2, C_2H_2, and C_2H_4) as a function of incident-electron kinetic energy (from about 20 to 60 eV) and scattering angle (from about −30° to +80°) with a resolution of 0.04 to 0.15 eV. These studies included the observation of twenty-nine electronically excited states, including 12 singlet → triplet transitions. Comparisons of these results with presently available theoretical predictions indicate the inadequacy of the latter. The vibrational structure within several electronic bands was resolved, and the relative vibrational intensities were compared with optical and calculated relative Franck–Condon factors. Discrepancies, due to underlying forbidden transitions, were noted in H_2, acetylene, and ethylene. Author (NSA)

N69-34199# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
EFFECT OF ELECTRON SCREENING ON THERMONUCLEAR REACTIONS UNDER HIGH DENSITIES
V. V. Portirev and Yu. N. Redkoborodyi 1969 30 p refs
(ITF-69-7) Avail: AEC Depository Libraries

The effect of electron screening of the Coulomb field of nuclei, which increases the thermonuclear fusion rate, is considered. The effective potential is derived by means of the self consistent field method based on the Hartree–Fock approximation. The influence of reacting nuclei on distribution of the screening space charge of electrons is taken into consideration. The screening contribution to interaction energy of colliding nuclei depends essentially on the self energy of the screening electron cloud. The results differ greatly from the results of other authors. Author (NSA)

N69-34213# Technische Hochschule Munchen (West Germany).
RPA CALCULATION IN ROTATING SYSTEMS [PPA-RECHNUNGEN IN ROTIERENDEN SYSTEMEN]
Johann Sulzer (Ph.D. Thesis) 1968 71 p refs In GERMAN
Avail: CFSTI

The general theory of vibration–rotation coupling in atomic nuclei is reviewed. The Hartree–Fock approximation method is summarized and applied to describe the spin-orbit model of rotating nuclei. Special care is taken to observe the principle of self-consistency. The moment of inertia is defined by means of eigenfunctions to the rotational impulse. The theory of Jancovici and Schiff is reviewed, with emphasis on the spurious states, and it is shown that one of the spurious states acquires a finite frequency during the transition to a rotating reference system. Numerical calculations are performed for the gg-nuclei in the sd-shell, proceeding from the Hamilton operator and the wave functions according to Kelson. Transl. by K.W.

N69-34216# Rome Univ. (Italy). Inst. of Physics.
MULTIPLE SCATTERING CORRECTIONS TO HIGH ENERGY π^+ PHOTOPRODUCTION
G. Benfatto, F. Nicolo, and G. C. Rossi 12 Mar. 1969 12 p refs *Its* Nota Interna 211
Avail: CFSTI

The Frantschi-Margolis model of multiple scattering corrections is extended to π^+B-photoproduction and gives very good agreement with experimental data for high energy differential cross sections up to $|t| \simeq 0.8(GeV/C)^2$. It is shown that there is no need for the pion's conspirator to reproduce the peak of the differential cross section in the forward direction. ESRO

N69-34218# Rome Univ. (Italy). Inst. of Physics.
A NUMBER-CONSERVING CALCULATION ON THE LOW ENERGY SPECTRA OF THE ODD-ODD Tl ISOTOPES
N. Lo Iudice, D. Prosperi, E. Salusti, and O. Stazi (Catania Univ.) 12 Mar. 1969 18 p refs *Its* Nota Interna 210
Avail: CFSTI

A calculation is reported of the low energy spectra of odd-odd Tl isotopes. The method used is a simplified version of a theory first suggested to treat pairing-correlations in nuclei without violating particle-number conservation. The nn and pp interactions are schematized by pairing Hamiltonians and the np interaction is a contact force having a J-dependent amplitude which, as shown by Pandharipande, schematizes a force containing both central and tensorial components. Author (ESRO)

N69-34223# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
HIGH RESOLUTION SPECTROSCOPIC STUDY OF THE DECAY OF THE Rb82m AND Rb 82g ISOTOPES
R. Broda, A. Z. Haynkienwicz, J. Styczen, Z. Szeglowski, and W. Walus 1969 20 p refs
(JINR-E6-4360) Avail: AEC Depository Libraries

Ge(Li) detector and Ge(Li)–Na(Tl) coincidence system. Gamma rays of the following energies were assigned to the decay of ^{82g}Rb (relative intensities in parenthesis): 698.1(1.2); 710.5(0.2); 776.9 (100.0); 1395(3.8); 1475.1(0.7); 1705(0.4); 2169(0.35); 2411(0.17); 2481(0.3); 2945(0.7) keV. In the decay scheme of ^{82g}Rb the following levels were determined: 776.9; 1475.1; 1487.4; 2172.4; 2481.0; 2945.0; and 3188.0 keV. The spin of the 2172.4-keV level was determined to be 0 by $\gamma\gamma$ directional studies of the 1395.5–776.9 keV cascade. Some limitations for the spin of the other levels were made. Author (NSA)

N69-34233# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
EFFECTIVE LAGRANGIANS AND FIELD ALGEBRAS WITH CHIRAL SYMMETRY
S. Gasiorowicz (Minnesota Univ., Minneapolis) and D. A. Geffen (Minnesota Univ., Minneapolis) Mar. 1969 186 p refs
(Contract AT(11-1)-1764)
(DESY-69/13) Avail: AEC Depository Libraries

A review is made of the recent developments of effective Lagrangians and field algebras as means of treating chiral symmetry and PCAC. The techniques employed are developed in considerable detail. As examples, spin-0 and −1 linear and nonlinear realizations of SU(2) × SU(2) and SU(3) × SU(3) are considered and some of

the significant predictions of the theory are derived. An extensive discussion is given of an effective Lagrangian with nonets of real scalar, pseudo-scalar, vector, and axial-vector mesons that illustrate the problems of broken SU(3) × SU(3). Author (NSA)

N69-34234# Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.

STUDY OF FISSION GAS RELEASE FROM UO SUB 2 SAMPLES IRRADIATED UP TO VARIOUS DOSES Final Report, 1 Nov. 1965 – 30 Apr. 1968

V. Baffigo, L. Giarda, G. Frigerio, and F. Polin Nov. 1968 26 p refs

(Contract EURATOM-043-65-TEEI(RD))

(EURAEC-2091; EUR-4011) Avail: CFSTI

The dependence on radiation dose of the D′ (1400°C) coefficient of ^{133}Xe diffusion in UO_2 as measured in post-irradiation annealing experiments, was studied. The measurements have been performed on UO_2 pellets, irradiated with doses from a few MWd/t to ≈8,000 MWd/t and on fused UO_2 samples of four different origins, irradiated with doses from a few MWd/t to ≈2,000 MWd/t. The dose effect on the release rate parameter of ^{133}Xe, consisting of a decrease in D′ with increasing radiation dose, appears to occur in fused UO_2 mostly during the first 100 MWd/t and is about 2 orders of magnitude. Both on fused UO_2 powders and grains an increase in D′, subsequent to a maximum in its initial decrease, was observed. This increase seems effective after a few hundreds MWd/t and brings the D′ values almost to their initial levels at about 2000 MWd/t. The high-density powders from four different origins (0.3 to 0.5 mm fractions) furnished D′ values approximately 2 orders of magnitude higher than corresponding values of high density grains (3 to 5 mm fractions). Author (NSA)

N69-34244# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

S SUB N CALCULATION OF THE TRANSPORT OF PARTICLES IN THE CYLINDRICAL SHIELDING

J. Rataj Feb. 1969 11 p refs In CZECH; ENGLISH summary

(UJV-2126-R) Avail: AEC Depository Libraries

The S_N solution of the one-dimensional Boltzmann equation in cylindrical multiregion geometry with anisotropic scattering is described. Attention is given first to adaptation of the scattering integral. The program, SNAN, was written for this method in the language, ALGOL, for the computer, GIER. A description of this program and a sample of the calculations are also included. Author (NSA)

N69-34246# University of Southern Calif., Los Angeles. Dept. of Physics.

NUCLEAR PHYSICS RESEARCH LABORATORY Annual Progress Report

Oct. 1968 59 p refs

(Contract AT(04-3)-136)

(USC-136-146) Avail: CFSTI

The activities of the Nuclear Physics Laboratory of the University of Southern California for the period Oct. 1, 1967 to Sept. 30, 1968 are described. Data are reported on various proton induced nuclear reactions, instrumentation and detector studies, and on charged particle energy losses in matter. Author (NSA)

N69-34248# Oak Ridge National Lab., Tenn.

REPORT TO THE AEC NUCLEAR CROSS SECTION ADVISORY COMMITTEE

P. H. Stelson Mar. 1969 16 p refs

(ORNL-TM-2543) Avail: CFSTI

This memo is a collection of brief reports on recent work at ORNL which is pertinent to the interests of the NCSAC. Author (NSA)

N69-34267# Aztec School of Languages, Inc., Maynard, Mass.

DOPING THIN CdTe LAYERS BY THE METHOD OF ION BOMBARDMENT PLUS TABLE OF CONTENTS

G. A. Kachurin, A. E. Gorodetskii, and L. S. Smirnov [1968] 7 p refs Transl. into ENGLISH from the book "Radiatsionnaya Fizika Nemetallicheskikh Kristallov, Trudy Soveshchaniya" Kiev, Izd. Naukova Dumka, 1967 p 262–265

(CONF-650995-1) Avail: CFSTI

Results of doping CdTe films with iodine ions at room temperature are presented. The resistance decrease is determined by the dose and energy; no correlation with current density of bombarding ions or film thickness was found. Equations are derived for the volume of disordered regions. The effects of annealing at 40 to 250°C were also studied. The activation energy for the resistance decrease was found to be 1.4 ± 0.3 eV, and at minimum resistance, the films had p-type conductivity and the mobility of the holes was 2 to 12 cm^2/V-sec. The resistivity increase on annealing above 200°C is due to iodine evaporation at the surface. The depth of the doped layer is 0.02 to 0.07 μ. NSA

N69-34269# Los Alamos Scientific Lab., N.Mex.

INTERACTIONS OF NUCLEONS WITH DEUTERONS, TRITONS, He 3, OR He 4 BETWEEN 30 MeV AND 1 GeV: A BIBLIOGRAPHY

John D. Seagrave, comp. and Betty S. Jackson, comp. 23 Apr. 1969 41 p refs

(Contract W-7405-eng-36)

(LA-4143) Avail: CFSTI

A bibliography of nucleon interactions with deuterons, tritons, helium-3 and helium-4 between 30 MeV and 1 GeV is presented. This bibliography was obtained from a search of Nuclear Science Abstracts. An author index is also provided. NSA

N69-34279# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.

THE MODEL OF A NEUTRAL PION-NUCLEON NONRENORMALISED INTERACTION WITHOUT ULTRAVIOLET DIVERGENCES

M. K. Volkov 1969 26 p refs In RUSSIAN; ENGLISH summary Presented at 2nd Conf. on Statist. and Phys. Kinetics, Kiev, Sep. 1968

(ITF-69-5; CONF-680949-6) Avail: AEC Depository Librararies

A new form of writing for the interaction Lagrangian in the neutral pseudoscalar theory with the pseudovector bond is suggested. The finite model with the unitary S-matrix is constructed by the help of it and a new method of transition to the momentum space. Author (NSA)

N69-34287# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

PSEUDOSCALER-VECTOR MESON SCATTERING IN THE VENEZIANO MODEL

A. Capela, B. Din, J. M. Kaplan, and D. Schiff May 1969 32 p refs

(Rept-69/28) Avail: CFSTI

An extension of the Veneziano model to pseudoscalar-vector meson elastic scattering is presented, in which the mother Regge trajectory of each family considered has definite parity (both possibilities are considered: natural and unnatural parity dominance).

The formulas obtained are then discussed from different points of view: factorization is not trivially satisfied in general, even for mother trajectories; the Adler self-consistency conditions are not automatically fulfilled, but can be imposed by relating the natural and unnatural parity contributions; as to superconvergence and finite energy sum rules, they give rise to some difficulties, which, although not specific of the spin case, are increased in this situation. Author

N69-34302# Los Alamos Scientific Lab., N.Mex.
RESONANCE SELF-INDICATION TECHNIQUE FOR ISOTOPIC ASSAY OF FISSILE MATERIALS
H. O. Menlove, C. D. Tesche, M. M. Thorpe, and R. B. Walton [1968] 30 p refs Presented at Intern. Conf. on the Construct. Uses of Atomic Energy, Wash. D.C.
(Contract W-7405-eng-36)
(LA-DC-9760; CONF-681101-24) Avail: CFSTI

A resonance self-indication technique was developed to nondestructively measure the thickness of fissile materials. This method utilizes the resonance structure in the neutron fission cross section by passing an epithermal beam of neutrons through the sample and then to thin fission detectors that are sensitive to the resonance absorption lines in the transmitted flux corresponding to the resonance reaction peaks. The measurements included samples of ^{233}U, ^{235}U, and ^{239}Pu with thicknesses ranging from 5 to 270 mils. The present measurements indicate that this technique could be used to measure the thickness of ^{239}Pu with an accuracy of 1 to 3%, and an accuracy of 2 to 10% for ^{233}U and ^{235}U. The influence of extraneous material in the samples was greatly reduced by using ratios of different fission detectors in the measurement. Computer calculations of the fission rates were made, and the theoretical results are in good agreement with the measurements. Author (NSA)

N69-34304# Los Alamos Scientific Lab., N.Mex.
DELAYED NEUTRON KINETIC RESPONSE METHODS FOR NONDESTRUCTIVE ASSAY OF REACTOR FUEL MATERIALS
C. N. Henry, H. O. Menlovve, and R. H. Augustson [1967] 4 p ref Presented at Intern. Conf. on the Construct. Uses of Atomic Energy, Washington, D.C.
(Contract W-7405-eng-36)
(LA-DC-9758; CONF-681101-21) Avail: CFSTI

Practical, on-line and in-the-field isotopic assay systems are being developed. The delayed neutron response technique of assay was applied to cold, clean MTR fuel elements. The resulting measured isotopic abundance agreed with the actual isotopic abundance to within 1%. NSA

N69-34309# Stanford Linear Accelerator Center, Calif.
THEORETICAL IDEAS ON HIGH-ENERGY INELASTIC ELECTRON-PROTON SCATTERING
J. D. Bjorken Mar. 1969 16 p refs Presented at the Am. Phys. Soc. Meeting, New York Sponsored by AEC
(SLAC-PUB-571; CONF-690209-1) Avail: CFSTI

Various features of the data on inelastic electron-proton scattering at 7 to 18 GeV reported by the MIT-SLAC group are examined. Other possible experiments which may exhibit scale-invariance of point like behavior at high transverse momentum are first discussed. Three theoretical descriptions of the data are then discussed: (1) the incoherent scattering from pointlike constituents within the proton; (2) vector dominance or Rutherford electron; and (3) current commutators. Finally, the implications of these models are discussed for future electron and muon scattering experiments such as electron scattering from deuterium, separation of σ_t from σ_l, the A-dependence of electron scattering from nuclei, and the nature of the final hadron states in these processes. NSA

N69-34310# California Univ., Livermore. Lawrence Radiation Lab.
NEUTRON AIR TRANSPORT CALCULATIONS
Walter M. Webster 8 Jan. 1969 70 p refs
(UCRL-50570) Avail: CFSTI

A series of Monte Carlo neutron air transport calculations was conducted for an isotropic, point neutron source in an homogeneous atmosphere. Twelve monoenergetic source energies ranging from 10 keV up to 14.1 MeV were investigated. The spatial and energy distribution of the transported neutrons was obtained out to a penetration depth of 160 g/cm^2. The transported neutron fluence was recorded in 28 energy groups between 0.015 eV and 14.6 MeV. The fluence in each of the 28 tally groups from each source energy calculation is described by a polynomial equation in the range from the neutron source. The coefficients which were obtained by the least squares method are given in tabular form. Author (NSA)

N69-34313# California Univ., Berkeley. Lawrence Radiation Lab.
TEMPERATURE DEPENDENCE OF THE HYPERFINE INTERACTION IN DILUTE NICKEL ALLOYS USING GAMMA-GAMMA PERTURBED ANGULAR CORRELATION
Stephen Saul Rosenblum (Ph.D. Thesis) Jan. 1969 111 p refs
(UCRL-18675) Avail: CFSTI

Perturbed angular correlation studies of temperature-dependent hyperfine fields at ^{111}Cd, ^{99}Ru, and ^{100}Rh solutes in nickel above and below the Curie point are presented. For $^{111}CdNi$, it is found that the hyperfine field is proportional to the lattice magnetization over the entire range of temperatures studied. For $^{99}RuNi$, this is not the case, and a molecular field model is described which accounts for this behavior by postulating a local moment on the ruthenium atom. For $^{100}RhNi$, all data was taken for $T_c < T \leq 1.2\ T_c$ and the hyperfine field was found to be proportional to the lattice magnetization. In addition, a time-dependent interaction is seen in this case, which is accounted for by a model based on the exchange-narrowing of a broadened Zeeman transition. Angular-correlation apparatus capable of 0.1% accuracy and a furnace capable of $\pm.5$°C stability over 24 hours for use with this apparatus are also described. Author (NSA)

N69-34328# Rome Univ. (Italy). Inst. of Physics.
T-VIOLATION IN HYPERON β-DECAY
C. Marchioro, A. Prosperetti (CNEN), and A. Pugliese 29 Jan. 1969 11 p refs *Its* Nota Interna 208
Avail: CFSTI

Some consequences of T-violation in Λ and Σ^- β-decays are studied, together with a possible simulation of such an effect by final state electromagnetic interactions. The conclusion is that within a wide experimental range there is no possibility of confusing the two sources of an observed T-odd correlation. By use of a model of CP-violation through second class currents, an upper bound for the T-violating effect is given. Experimental possibilities of testing this model are briefly discussed. Author (NSA)

N69-34329# Wuerzburg Univ. (West Germany). Physikalisches Inst.
GROUND-STATE AND SADDLE-POINT PROPERTIES OF HEAVY NUCLEI FOR A DYNAMIC FISSION THEORY [GRUNDZUSTANDS UND SATTELPUNKTSEIGENSCHAFTEN

SCHWERER KERNE FUER EIN DYNAMISCHES MODELL DER KERNSPALTUNG]
R. W. Hasse Sep. 1968 26 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-68-46) Avail: AEC Depository Libraries

Ground states and saddle points of the heavy elements thorium to fermium were calculated with a modified liquid-drop formula including curvature and shell-energy corrections. Intrinsic quadrupole moments and fission barriers were compared with experimental data. Relative moments of inertia at the saddle point were computed. Three degrees of freedom were allowed: elongation, asymmetry and constriction, which at the saddle point are equivalent to the three normal modes of oscillation: fission, asymmetry, and vibration. The normal stiffnesses and normal masses of these modes are presented. Fission-barrier curvatures were compared with those achieved by experiments. Statistics of the initial coordinates in the vicinity of the saddle were performed for low-energy fission of heavy elements. Author (NSA)

N69-34332# Technische Hochschule Munchen (West Germany). Inst. fuer Radiochemie.
OXYGEN DETERMINATION BY FAST NEUTRON ACTIVATION ANALYSIS [ZUR AKTIVIERUNGSANALYTISCHEN BESTIMMUNG VON SAUERSTOFF MIT SCHNELLEN NEUTRONEN]
J. I. Kim and R. Henkelmann Bad Godesberg, W. Germany Bundesministerium fuer Wissenschaftliche Forschung Dec. 1968 17 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-68-58) Avail: AEC Depository Libraries

For the analysis of oxygen by neutron activation the fast neutrons of a reactor neutron spectrum as well as the 14-MeV neutrons of a small accelerator can be used. The advantages and disadvantages of the two methods are discussed. A number of examples illustrating sensitivity, selectivity, reproducibility, and neutron flux monitoring are given. Author (NSA)

N69-34348# Rome Univ. (Italy). Inst. of Physics.
GROUND-STATE OF ONE-DIMENSIONAL N-BODY SYSTEM
F. Calogero (Istituto Nazl. Fis. Nucl.) 11 Mar. 1969 14 p refs Submitted for publication *Its* Nota Interna 207
Avail: CFSTI

The problem of N quantum-mechanical equal particles interacting pair-wise by inverse-cube forces ('centrifugal potential') in addition to linear forces ('harmonical potential') is considered in a one-dimensional space. An explicit expression for the ground-state energy, and for the corresponding wave function, is derived. A class of excited states is also discussed. Author (ESRO)

N69-34349# Rome Univ. (Italy). Inst. of Physics.
RADIATIVE CORRECTIONS TO THE LEPTON POLARIZATION AND TO THE RATE IN K^{+}_{l3} DECAY
C. Benfatto, F. Nicolo, and G. C. Rossi 10 Mar. 1969 25 p refs *Its* Nota Interna 208
Avail: CFSTI

Radiative corrections to the lepton polarization and the rate in K_{l3} decay are calculated. The are found to be very small and strongly cutoff-dependent for the latter. Author (ESRO)

N69-34354# Stanford Linear Accelerator Center, Calif.
HIGH ENERGY PHOTOPRODUCTION AND ELECTROPRODUCTION
Frederick J. Gilman Apr. 1969 47 p refs Presented at the Conf. on Particle Interactions at High Energies, Toronto, Can. Sponsored by AEC
(SLAC-PUB-589; CONF-690316-1) Avail: CFSTI

A review is given of some of the recent experimental and theoretical developments in the field of high energy photoproduction and electroproduction. The topics covered include pion photoproduction, vector dominance model, sign of $\pi^0 \rightarrow \gamma\gamma$ decay amplitude, vector meson photoproduction, multibody photoproduction, and high energy electroproduction. NSA

N69-34358# Rome Univ. (Italy). Istituto di Fisca.
RADIATIVE CORRECTIONS TO THE LEPTON POLARIZATION AND TO THE RATE IN K3 DECAY
G. Benfatto, F. Nicolo, and G. C. Rossi 10 Mar. 1969 24 p refs *Its* Internal Note No. 208
(NP-17872) Avail: AEC Depository Libraries

Radiative corrections to the lepton polarization and to the rate in K_3 decay are calculated. They are found to be very small and for the rate strongly cutoff dependent. Author (NSA)

N69-34361# California Univ., Berkeley. Lawrence Radiation Lab.
STUDY OF THE REACTIONS NEGATIVE KAON PLUS PROTON YIELDS PROTON PLUS NEUTRAL KAON PLUS NEGATIVE PION, NEGATIVE KAON PLUS PROTON YIELDS PROTON PLUS NEUTRAL KAON PLUS NEUTRAL PION PLUS NEGATIVE PION, AND NEGATIVE KAON PLUS PROTON YIELDS NEUTRON PLUS NEUTRAL KAON PLUS POSITIVE PION PLUS NEGATIVE PION, FROM 2.1 TO 2.7 GeV/c
Jerome H. Friedman Apr. 1969 311 p refs
(Contract W-7405-eng-48)
(UCRL-18860) Avail: CFSTI

The reactions $K^-p \rightarrow p\bar{K}^0-$, $K^-p \rightarrow p\bar{K}^0\pi^0-$, and $K^-p \rightarrow n\bar{K}^0\pi^+\pi^-$ are studied in detail in the LRL 72-in. hydrogen bubble chamber in the center-of-mass energy range 2.27 to 2.51 GeV. Total cross sections for these reactions as a function of center-of-mass energy are presented. Copious resonance production is observed in all of these final states. This resonance production is studied with the aid of a maximum likelihood technique and the relative rates of the well known resonances are presented as a function of center-of-mass energy. The differential cross section and decay correlation parameters are measured as a function of production angle and center-of-mass energy for the reaction $K^-p \rightarrow K^*_{1/2}{}^-(892)\,p$ using the likelihood method. The differential cross section and parameters of the joint decay angular distributions for the double resonance production reaction $K^-p \rightarrow \bar{K}^*_{1/2}(892)\,N^*_{1/2}(1238)$ are also measured as a function of production angle and center of mass energy. The results of the analyses on the reactions $K^-p \rightarrow K^*_{1/2}{}^-(892)\,p$ and $K^-p \rightarrow \bar{K}^*_{1/2}(892)\,N^*_{1/2}(1238)$ are compared to the predictions of the absorptive peripheral model, the Regge pole model, and the quark model. Finally, the $K\pi\pi$ mass spectra are studied and the structure therein discussed. Author (NSA)

N69-34370# Rome Univ. (Italy). Istituto di Fisica.
BETA-DECAY OF HYPERONS
C. Marchioro, A. Prosperetti (Comitato Nazl.i., Per L'Energia Nucl., Frascati, Italy), and A. Pugliese 13 Mar. 1969 22 p refs *Its* Internal Note No. 212
(NP-17889) Avail: AEC Depository Libraries

The β-decay of hyperoons is studied in the framework of the current X current theory of weak interactions. Results are expressed in a manageable form for experimental purposes. Numerical calculations are performed for the Λ and Σ^- decays and informations obtainable from experiments are discussed. Author (NSA)

N69-34372# Rome Univ. (Italy). Istuto di Fisica.
MULTIPLE SCATTERING CORRECTIONS TO HIGH ENERGY POSITIVE PION PHOTOPRODUCTION
G. Benfatto, F. Nicolo, and G. C. Rossi 12 Mar. 1969 11 p refs *Its* Internal Note No. 211
(NP-17871) Avail: AEC Depository Libraries

The Frautschi–Margolis model for generating multiple scattering corrections in the form of Regge cuts is extended to the π^+ photoproduction, obtaining for the high energy differential cross section a very good agreement with experimental data. NSA

N69-34388# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
MULTIGROUP CROSS SECTIONS CALCULATION FOR USE IN S SUB N
J. Rataj Feb. 1969 16 p refs In CZECH; ENGLISH summary
(UJV-2129-R) Avail: CFSTI

The calculation of multigroup cross sections for use in S_N calculations of the Boltzmann equation is described. The methods of calculation of these constants for neutrons and photons are presented. The programs MUN and MUG, were written for these methods in the language, ALGOL, for the computer, GIER. Descriptions of these programs are also included. Author (NSA)

N69-34395# Academia R. P. R., Bucharest. Institutul de Fizica Atomica.
MICROSCOPIC DESCRIPTION OF THE TWO PARTICLE STRIPPING ON DEFORMED NUCLEI
I. Brandus, O. Dumitrescu, and A. Sandulescu 1968 27 p refs
(IFA-FT-73) Avail: AEC Depository Libraries

A microscopic finite range approximation formalism for two particle stripping reactions on deformed nuclei is developed. A new method for the calculation of the stripping matrix elements is given. The method is based on the expansion of the plane or distorted-wave functions as a product of a Gauss function and an expansion in terms of harmonic oscillator wave functions. The exclusion principle is taken into account, and the exchange contribution to the cross section is obtained. A detailed treatment is given for the case of alpha,d- stripping reations on deformed nuclei. Author (NSA)

N69-34396# Gosudarstvennyi Komitet po Ispolzovaniyu Atmnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.
YIELDS OF K-MESONS, ANTIPROTONS, AND OTHER SECONDARY PARTICLES IN PROTON-NUCLEUS INTERACTIONS ON VARIOUS TARGETS AT ENERGIES OF 6 TO 10 GeV (SURVEY)
I. S. Tsukerman 1968 40 p refs In RUSSIAN
(ITEF-620) Avail: AEC Depository Libraries

This survey gathers together published data on the production of charged K-mesons and antiprotons during proton–nucleus interactions on various targets when the kinetic energy of the protons ranges from six to ten GeV. Some data are also given on the yields of π-mesons and other secondary particles at various energies. Formulas and graphs are given in the appendix for theoretical evaluation of the yields of secondary particles. Author (NSA)

N69-34421# Duke Univ., Durham, N.C.
A MULTI-EXIT CHANNEL STUDY OF ANALOG RESONANCES IN THE V-51 PLUS p REACTION
H. Coleman, M. Divadeenam, W. McEver (N.C. Univ.), J. M. Joyce, (N.C. Univ.), E. J. Ludwig (N.C. Univ.) et al [1969] 7 p refs Presented at the Conf. on Isobaric Spin, Pacific Grove, Calif.
(CONF-690310-4) Avail: CFSTI

Excitation curves were obtained over the proton energy range of 2.15 to 3.15 MeV for γ rays and ground-state neutrons arising from the $^{51}V(p,p'\gamma)$, $^{51}V(p,n\gamma)$ and $^{51}V(p,n_0)$ reactions. Targets were ≈10 keV thick. Gamma rays were detected with a 20 cc Ge(Li) detector. Only effects which occurred in several exit channnels simultaneously were assumed to be intermediate resonances. If they also occur at excitation energies in ^{52}Cr corresponding to known levels in ^{52}V they were considered to be analog resonances. Seventeen γ-ray angular distribution measurements were made at most of the analog resonance energies. These measurements, when compared with theory, together with the presence of resonances in certain exit channels leads to spin-parity assignments for resonances in chromium 52 and levels in vanadium 52. Author (NSA)

N69-34425# Avco-Everett Research Lab., Everett, Mass.
THE "HIPAC" AS A SOURCE OF HIGHLY STRIPPED HEAVY IONS
J. D. Daugherty, J. E. Eninger, G. S. Janes, and R. H. Levy Apr. 1969 24 p refs
(Contract AT(30-1)-3863)
(NYO-3863-12; RR-333) Avail: CFSTI

The HIPAC ion source is a novel device intended to produce very highly stripped heavy ions; the achievement of this objective would permit the acceleration of heavy ions in relatively modest cyclotrons, linacs etc. The problem of stripping heavy ions by successive electron impacts is discussed in general terms. The HIPAC ion source is then described using for illustrative purposes a nominal set of characteristic parameters. A torus 20 cm in major radius is estimated to yield 10^{13} ions/sec of Kr^{20+} or 10^{11} ions/sec of U^{60+}. The current status of experimental work on the concept is briefly reviewed. Author (NSA)

N69-34426# Brookhaven National Lab., Upton, N.Y.
RADIATION-INDUCED POLYMERIZATIONS IN CONTINUOUS STIRRED TANK REACTORS
H. T. Chen (Newark Coll. of Eng.) and F. S. Hill Oct. 1968 36 p refs Presented at the Advan. in High-Pressure Technol. Symp., New Orleans, La.
(BNL-13037; CONF-690307-3) Avail: CFSTI

A theoretical study of the performance characteristics of continuous stirred tank reactors when used to conduct radioinduced polymerizations is presented. The effects on conversion and molecular weight distribution of the interaction of radiation attenuation, chemical kinetics, and mixing are examined for initiation by ultraviolet light and by cobalt 60 gamma radiation. Author (NSA)

N69-34428# Timisoara Univ. (Rumania). Dept. of Physics.
STATISTICAL MODEL CALCULATION OF THE BRANCHING RATIOS OF N(1470)
A. Abramovici and L. Vekas Jan. 1969 7 p refs
(NP-17870) Avail: AEC Depository Libraries

A statistical model was used to obtain the branching ratios of N*(1470). The ratios found agree with those obtained by other methods. Considering that the σ(410) dipion resonance does not exist, a branching ratio of 0.637 was found for the elastic channel very near to that obtained in other papers. This supports the nonexistence of σ(410). Author (NSA)

N69-34429# Gosudarstvennyi Komitet po Ispolzoveniyu Atomnoi Energii, Leningrad (USSR).
SIMULATION OF A VORTEX ELECTRICAL FIELD IN AN ELECTROLYTIC BATH
Yu. P. Vakhrushin and O. V. Semenov 1968 13 p refs In RUSSIAN
(NP-17803) Avail: AEC Depository Libraries

Linear induction accelerators have been proposed to create electron beams with relativistic energies by means of vortex electric fields. The difficulties in the calculation of these fields may be simplified by making use of the similarity with static electric and magnetic fields which are based on the same equations and boundary conditions. Such a model was developed on the basis of electric vortex fields generated by a series of pulse transformers in electrolytic system. The results were used to determine the accelerating field of the LIU-3000 linear accelerator, comparing it with the accelerating portion of the Astron machine. A model was built to obtain the tension of the electric vortex field excited by 12 magnetic toroids surrounded by a conductive shell, using an ac bridge with an oscillograph as the zero indicator to determine the equipotential lines. The system made it possible to determine the conditions under which the field becomes strongly nonuniform.
NSA

N69-34443# California Univ., Livermore. Lawrence Radiation Lab.
PRELIMINARY STUDIES IN NONDISPERSIVE X-RAY FLUORESCENT ANALYSIS OF BIOLOGICAL MATERIALS
Fred P. Cranston and Lynn R. Anspaugh 6 Jan. 1969 18 p refs
(UCRL-50569) Avail: CFSTI

Initial efforts to use a Ge(Li) detector for the nondispersive x-ray fluorescence analysis of biological samples are described. The judicious use of collimators was found to greatly improve sensitivity. For barium in a cellulose matrix the limit of detection was about 20 μg with a counting time of 650 minutes, and with the use of a 3 Ci ^{241}Am source. The presence of scattered background radiation was found to be the limiting factor. Further improvement may be expected by improving the geometry but not by increasing the source strength.
Author (NSA)

N69-34446# Brookhaven National Lab., Upton, N.Y.
Tc-99m: AN INEXPENSIVE ROUTE TO A VERSATILE RADIOISOTOPE
P. Richards 22 Apr. 1969 24 p refs Presented at the Conf. on Radiation and Isotope Technol. in Latin Am. Develop., San Juan, Puerto Rico
(BNL-13564; CONF-690508-1) Avail: CFSTI

The use of short-lived isotopes in medical diagnostic procedures is one of the areas showing the most rapid growth in the use of radioisotopes today. Two short-lived radionuclides, ^{18}F and ^{99m}Tc, in the form of various labeled pharmaceuticals are useful in most of today's clinical procedures. Both of these nuclides can be produced in reactors available to these centers. A solvent extraction technique was developed that makes possible the separation of the high quality ^{99m}Tc from low-specific activity parent ^{99}Mo. The development of a close working arrangement between nuclear and medical centers can result in a modern nuclear medicine program using these nuclides and which can be carried out with a maximum degree of self sufficiency.
Author (NSA)

N69-34453# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noit Fiziki.
ON SOME MODEL OF RENORMALIZABLE WEAK INTERACTION [OB ODNOI MODELI PERENORMIRUEMOGO SLABOGO VZAIMODEISTUIYA]
E. P. Shabalin 1969 22 p refs In RUSSIAN; ENGLISH summary
(ITEF-635) Avail: AEC Depository Libraries

The model of renormalizable weak interaction formulated by Kummer and Segre for leptonic interactions is extended to hadron – lepton and nonlepton processes. Using methods analogous to those of the current algebra, it is shown that the theory leads to the equality of the vector constants of the neutron and muon decay. A new solution of the problem of neutral currents is proposed and a criterion of applicability of the model to the nonleptonic weak interactions is presented. The model does not contradict experimental data and has no difficulties of conventional weak interaction theory at high energies. Experiments to check the validity of the model are proposed.
Author (NSA)

N69-34461# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
CROSS COOLANT MIXING AND ITS EFFECT ON HOT CHANNEL TEMPERATURES IN STEAM-COOLED FAST REACTORS
K. Doetschmann [1968] 24 p refs Transl. into ENGLISH from the German Report KFK-848
(EURFNR-598; KFK-848) Avail: CFSTI

The calculation for the two core variants of the ENEA reference reactor shows that without coliant cross-mixing in the hot channel, peak temperatures of 739° or 769°C would occur at the clad inside as against rated figures of 597 and 628°C. Even in the event of perfect mixing, these high temperatures are only reduced to 673 and 711°C, because they have several causes, most of which are not influenced by coolant cross-mixing. With the coliant cross mixing which is actually to be expected, the max. clad temperatures are approx. 700 or 735°C. The temperature gain is thus 40 to 35°C. It is also seen that even bigger deviations from the coliant cross-mixing quantities considered would only modify the calculated temperatures slightly.
Author (NSA)

N69-34462# Kyoto Univ., (Japan). Research Reactor Inst.
HEAVY-ION NUCLEAR PHYSICS
Takeo Hayashi, comp. and Masakatsu Mukaizaka comp. [1968] 61 p refs In Japanese
(KURRI-TR-18) Avail: AEC Depository Libraries

Abstracts of papers dealing with nucleon transfer reactions, compound nucleus processes, heavy ion elastic scattering, calculations of elastic scattering with the optical model, nucleus-nucleus molecular state and related items, experiments at Berkeley (elastic scattering of heavy ions), Coulomb excitation by heavy ions, doppler effect by heavy ions, and Coulomb excitation (the Copenhagen experiments), charge transformation collisions of C ion, experiments to study nuclear surfaces using heavy ions, synthesis of transuranium elements by heavy ions, acceleration of C and N ions with the Tokyo University cyclotron, heavy ion sources, linear accelerator for heavy ions, and comparisons of heavy ion acceleration are presented.
Author (NSA)

N69-34463# Argonne National Lab., Ill.
TRANTEMP: A CODE FOR CALCULATING TRANSIENT TEMPERATURE DISTRIBUTIONS IN REACTOR HYDRAULIC RABBIT FACILITIES
Bryant N. Kristianson Nov. 1968 106 p refs
(Contract W-31-109-eng-38)
(ANL-7496) Avail: CFSTI

Written in FORTRAN for the CDC-3600 computer, the TRAN-TEMP code solves a set of numerical heat-balance equations. These equations describe the space- and time-dependent temperatures prevailing in a cylindrical, hydraulic rabbit assembly,

which is heated by nuclear radiation and cooled by flowing water. Included are the mathematical model, the computer input specifications a sample problem, and a FORTRAN listing of the code. Author (NSA)

N69-34465# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'Noi Fiziki.

ON THE POSSIBILITY OF MEASURING THE IONIZATION CAPACITY OF A PARTICLE IN A SPARK CHAMBER WITH SMALL GAPS

A. O. Agan'yants, G. A. Leksin, and V. M. Tiunchik [1968] 11 p refs In FRENCH Transl. into FRENCH from the Russian Report ITEF-603

(CERN-TRANS-68/16; ITEF-603) Avail: AEC Depository Libraries

Here are presented some quantative data on the relation between the ionization capability of the particle and characteristics of the photograph image of the spark belonging to the correspondent track in a spark chamber with small gaps. The possibility to measure the ionization density by the comparison of characteristics of the particle spark and ones of the special standard spark initiated simultaneously in the same discharge gap is considered. Author (NSA)

N69-34472# California Univ., Livermore. Lawrence Radiation Lab.

ANALYSIS OF FLUX REVERSAL IN TAPE CORES

S. D. Winter and R. W. Kuenning 27 Mar. 1969 10 p refs Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N. Mex., 8-11 Apr. 1969 Sponsored by AEC

(UCRL-71552; CONF-690407-16) Avail: CFSTI

Part of a study on magnetic cores which are used to couple energy to the beam in the Astron accelerator was the development of a theory explaining the drive requirements of the cores. An existing theory on flux reversal, the saturation-wave theory, predicts an increase throughout the pulse for cores with an aspect ratio (o.d./i.d.) of 1. To obtain quantitative results for the Astron cores, first it was necessary to extend the theory to include an aspect ratio greater than 1. Excellent agreement was then achieved between predicted and measured values of good cores during the latter part of the pulse. Next, a threshold leval of the magnetic field to cause a change of induction in the tape was introduced which led to close agreement between the predicted and measured currents throughout the entire pulse. Comparison of predicted and measured currents are given for both good and bad cores with a qualitative discussion on the causes of bad cores. Author (NSA)

N69-34473# California Univ., Berkeley. Lawrence Radiation Lab.

THE (p,t) AND (p, He) REACTIONS ON (2s-1d) SHELL NUCLEI

Heinz Brunnader (Ph.D. Thesis) Jan. 1969 172 p refs

(Contract W-7405-eng-48)

(UCRL-18716) Avail: CFSTI

The excitations of high isospin (T = 2) analogue states in the $T_z = 0$ and the $T_z = +1$ A = 4n nuclei were measured for the entire (sd) shell using the (p,t) and (p,^{3}He) reactions induced by 45-MeV protons. The reactions ^{40}Ar(p,t)^{38}Ar and ^{40}Ar(p,^{3}He)^{38}Cl were utilized to observe the first T = 3 analogue states in the $T_z = 1$ and $T_z = 2$ nuclei. In addition to these high T states, a number of T = 1 analogue states were also observed. The ratio of the observed cross sections for these T = 1 analogue states was compared with the ratio predicted from the DWBA cross section expressions. The (p,t) reaction was further utilized to extend the range of known excitations in the nuclei ^{18}Ne and ^{34}Ar. All Coulomb displacement data in the (1p) and ($1d_{5/2}$) shells, including those derived from this work, were fitted to parameterized Coulomb displacement energy formula derived to jj-coupling low seniority and Wigner supermultiplet schemes. The results were used to predict the masses of yet unmeasured neutron deficient nuclei in this region. Author (NSA)

N69-34475# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.

EXCITATION OF ISOBAR-ANALOGUE STATES IN REACTIONS OF ELASTIC SCATTERING AND RADIATION CAPTURE OF PROTONS

V. M. Kolomiets and Yu. V. Tsekhmistrenko 1968 33 p refs In RUSSIAN

(ITF-68-84) Avail: AEC Depository Libraries

The theory of resonance proton reactions on heavy nuclei (N-Z >> 1) with excitation of isober-analog states is discussed. The theory takes into account different operied channels (p,p), (p,γ), (p,p'), (p,n). Simple formulas to determine nucleon and radiation widths of the analog states were obtained. The effect of isotopic spin nonconservation and a thin resonance structure arising is discussed. A numerical calculation of nucleon and radiation widths in reactions ^{88}Sr(p,p), ^{88}Sr(p,γ)^{89}Y at energies below the Coulomb barrier $E_p < \Delta_c \sim 1.13\ A^{1/3}$ MeV was performed. A contribution both from resonance and direct capture mechanisms was calculated in the radiation capture cross section σ(p,γ_0). All the results obtained were compared with experimental data. Author (NSA)

N69-34477# Thermo Electron Corp., Waltham, Mass.

RESEARCH AND DEVELOPMENT OF VACUUM FOIL-TYPE INSULATION FOR RADIOISOTOPE POWER SYSTEMS Quarterly Progress Report, Dec. 1968 - Feb. 1969

J. Carvalho, J. B. Dunlay, J. Fronduto, M. L. Paquin, and V. L. Poirier 29 Apr. 1969 59 p

(Contract AT(30-1)-3634)

(ALO-3634-12; TE-4059-154-69; QPR-6) Avail: CFSTI

Progress on the development of high-temperature thermal insulation for radioisotope power systems is reported. 80-, 120-, and 200-layer Ta–ThO_2 insulation samples were tested under pressures of 2.1 and 5.2 psi. The 200-layer sample was able to limit the transmitted heat flux to .05 watt/cm^2 at 1700°C. This corresponds to a mean thermal conductivity of 9.6×10^{-5} watts/cm°C. The layer variation measurements were continued with 80-, 120-, 160-, and 200-layer samples tested under zero pressure. In addition, two additional groups of reproducibility measurements were initiated and partially completed. A reinforced version of the concentric cup corner assembly was tested. The results represent a considerable improvement over those obtained by testing the original corner. Low temperature 40-layer SS–ZrO_2 data are presented along with preliminary 40-layer Ti–ZrO_2 data and 80-layer SS–ZrO_2 data. Author (NSA)

N69-34479# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

VECTOR MESON DOMINANCE AND PHOTOPRODUCTION

D. Schildknecht Feb. 1969 35 p refs

(DESY-69/10) Avail: AEC Depository Libraries

The vector meson dominance model of photoproduction is reviewed with an emphasis on the most recent results. Author (NSA)

N69-34487# Gulf General Atomic, San Diego, Calif.

THE U-235 CAPTURE CROSS SECTION Final Technical Report

A. D. Carlson 30 Oct. 1968 33 p refs
(Contract AT(04-3)-167)
(GA-9057) Avail: CFSTI

Capture and self-indication measurements were made concurrently on a ^{238}U sample placed in the neutron beam from a 28-MeV electron linac using a fansteel target. Capture cross section curves are shown for the neutron energy range 0.01 eV to 20 keV. Derived gamma and neutron widths are tabulated for 29 resonances from −9.7 to 415 eV, and energies only are given for 34 resonances to 996 eV. The thermal capture cross section (5.1 ± 0.25 b) and resonance capture integral (350 ± 25 b) were derived and compared to the values obtained by other workers. The average s- and p-wave strength functions and average reduced neutron width and average radiative width are given. NSA

N69-34490# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
NUCLEAR PROPERTIES OF HELIUM-COOLED FAST BREEDER REACTOR [NUKLEARE EIGENSCHAFTEN HELIUMGEKUEHLTER SCHNELLER BRUTREAKTOREN]
E. Eisemann Oct. 1968 23 p refs In GERMAN
(KFK-864; EUR-4155.d) Avail: AEC Depository Libraries

Design parameters for helium cooled fast breeders are tabulated for oxide, metal-cermet, and carbide cores; each type of core is described. Nuclear characteristics for each type of core are tabulated. Calculational methods are discussed; expressions for the nuclear parameters are given. Spectral determinations for each core-type are shown as functions of lethargy and energy. NSA

N69-34492# Purdue Univ., Lafayette, Ind.
STUDY OF NEUTRAL D-MESON DECAY TO POSITIVE (NEGATIVE) PION PLUS NEGATIVE (POSITIVE) DELTA MESON AND POSITIVE (NEGATIVE) DELTA MESON DECAY TO NEGATIVE (POSITIVE) PION PLUS NEUTRINO
J. H. Campbell, S. Lichtman, F. J. Loeffler, D. H. Miller, R. J. Miller et al
(COO-1428-117) Avail: CFSTI

In π^+ +d interactions at 2.7 GeV/c the D0 meson was observed with mass 1.27 ± .01 GeV/c^2 and width 30 ± 15 MeV/c^2 to decay to the δ^+ meson with mass 98 ± .01 GeV/c^2 and width 40 ± 15 MeV/c^2. The δ^- meson is further observed to decay into $\pi\eta$ with both neutral and charged decays of the η.
Author (NSA)

N69-34499# Brookhaven National Lab., Upton, N.Y. Information Div.
ON THE SPIN DEPENDENCE OF THE INTERACTION OF SLOW NEUTRONS WITH DEUTERIUM, NITROGEN, AND LANTHANUM NUCLEI
A. I. Ivanenko et al 1968 11 p refs Transl. into ENGLISH from Russian Report JINR-P3-4185
(BNL-tr-263; JINR-P3-4185) Avail: CFSTI

The transmission effect and polarization cross sections were measured for the interaction of slow polarized neutrons with deuterium, lanthanum, and nitrogen. From these data the quartet and doublet n-d scattering lengths were determined. NSA

N69-34501# Scientific Translation Service, Ann Arbor, Mich.
EXPERIMENTAL SITUATION ON ELASTIC PION-NUCLEON SCATTERING BELOW 2 GeV
Pierre Bareyre, Claude Bricman, and Gerard Villet Dec. 1967 34 p refs Transl. into ENGLISH from the French Report CEA-R-3401 Prepared for Oak Ridge Natl. Lab.
(ORNL-TR-1926; CEA-R-3401) Avail: CFSTI

Experimental results from various studies of $\pi^+ + p$ interactions are presented. These data concern the total cross sections, elastic and charge exchange distributions, the polarization of the recoil proton in elastic scattering and coherence of the method of determination. NSA

N69-34514# Hamburg Univ. (West Germany). Institut fuer Theoretische Physik.
CURRENT-FIELD COMMUTATORS AND THE BARYON SPECTRUM
H. Genz, J. Katz, and S. Wagner Jan. 1969 10 p refs
(DESY-69/4) Avail: AEC Depository Libraries

The equal-time commutator between the time component of the axial vector current an the baryon field is assumed to be proportional to the field itself. We use the technique of M. Sugawara to fix the proportionality factor r in the commutator. Consideration of the P_{33} resonances Δ_{3}(1236) and Δ_{3}(1688) together with the D_{33}resonance Δ_{3}(1691) gives three possible values of $|r|$. Study of the S_{11} resonance N_4(1709) together with the P_{11}baryons N_1(940) and N_2(1466) shows that the experimental decay widths GG experimental decay widths $\Gamma(N_4 \rightarrow N_1 + \pi)$ and $\Gamma(N_2 \rightarrow N_1 + \pi)$ select $r \approx \pm 1.2$. The value of $|r|$ so obtained is in agreement with that which one can deduce using the Jacobi identity and current algebra. Author (NSA)

N69-34515# Hamburg Univ. (West Germany). Institut fuer Experimental-physik.
POSITIVE PION PRODUCTION WITH LINEARLY POLARIZED PHOTONS
C. Geweniger, P. Heide, V. Koetz, R. A. Lewis, P. Schmueser et al Feb. 1969 10 p refs
(DESY-69/5) Avail: AEC Depository Libraries

Single π^+ production on protons by linearly polarized photons of 2.5 to 5 GeV was measured at squared four momentum transfers t between −0.01 and −0.6 (GeV/c)^2. The results show that the differential cross section $d\sigma_\perp/dt$ with the electric vector of the photon perpendicular to the reaction plane is much larger than $d\sigma_\parallel/dt$ with the electric vector parallel to the reaction plane. The predictions of Regge models and of the vector meson dominance model are briefly discussed. Author (NSA)

N69-34516# California Inst. of Tech., Pasadena.
CROSSING MATRICES FOR SU(2) AND SU(3)
Richard Slansky and Claudio Rebbi 22 Jan. 1969 29 p
(Contract AT(11-1)-68)
(CALT-68-182; CTSL-IR-42) Avail: CFSTI

A pedestrian derivation of the SU(2) and SU(3) crossing matrices is given. The phases and phase conventions are discussed in detail without using the apparatus of field theory. A number of crossing matrices are computed. Author (NSA)

N69-34518# California Univ., Santa Barbara.
HIGH ENERGY USER GROUP AT SANTA BARBARA Progress Report, May 1968 – Mar. 1969
David O. Caldwell Mar. 1969 10 p refs
(Contract AT(11-1)-34)
(UCSB-34-P-135-8) Avail: CFSTI

The completed experiments include experiments to measure cross sections for the forward photoproduction of neutral pseudoscalar and vector mesons by observing the accompanying recoil protons, and $\pi^+ - \pi$ and $\pi^+ - \pi^-$ and $\pi^+ - \pi^-$ lifetime determinations. The experiments in progress are the measurement of the total photoabsorption cross section for producing hadrons and the measurement of the total photoabsorption cross section as a function of A for hadron final states. NSA

N69-34519# California Univ., Berkeley. Lawrence Radiation Lab.
ISOSPIN PURITY AND DECAY OF THE T EQUALS 3/2 ANALOGUE STATE IN F-17
J. C. Hardy, John E. Esterl, R. G. Sextro, and Joseph Carny Feb. 1969 6 p refs Presented at the Conf. on Isobaric Spin, Pacific Grove, Calif.
(Contract W-7405-eng-48)
(UCRL-18774; CONF-690310-3) Avail: CFSTI

All allowed β^+-decay branches of the $T_z = -3/2$ nucleus ^{17}Ne lead to states in ^{17}F which are above the proton separation energy. From the relative intensities of the emitted proton groups absolute log ft values can be determined for all significant branches, including the superallowed decay to its T = 3/2 analogue in ^{17}F (E_x = 11.197 MeV). TiO_2 foils were bombarded with a 45-MeV $_3$He beam and the recoils swept with helium into a well-shielded counting chamber 15 feet away in ≈100 msec. Particle decays were detected in a ΔE-E counter telescope (FWHM = 40 keV) and particle γ coincidences were observed using a NaI(Tl) detector. The analog state was observed to emit protons to the ground, first, third, and fourth excited states of 16O. The log ft value for the decay branch feeding it was determined to be 3.35 ± 0.10, indicating that the isospin purity of the state is ≈ 87%. Author (NSA)

N69-34520# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.
ASSESSMENT OF A LOW-PRESSURE CLOUD CHAMBER FOR RANGE MEASUREMENTS OF LOW-ENERGY ELECTRON TRACKS
H. J. Delafield Dec. 1968 36 p refs
(AERE-R-5991) Avail: CFSTI; UK 5s 6d

An investigation was carried out into the potentialities of a low pressure cloud chamber for measuring the energy deposition by ionizing particles of low energy. This information is required for a fuller understanding of the relationship between radiobiological effect and radiation quality. The construction and operation of a small cloud chamber is described, and its performance assessed using an α-source and 1.5 keV characteristic x rays, down to a pressure of about 10 cm Hg. These studies have shown that it should be possible under these conditions to measure the penetration ranges of electrons down to about 1 keV, but that individual droplets cannot be readily resolved. Difficulty was experienced in expanding the chamber with sufficient precision to control the rapid diffusion of ions during the initial stage of droplet growth. Author (NSA)

N69-34521# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.
AUTOMATIC COUNTER FOR PROTON TRACKS IN NUCLEAR EMULSIONS
G. H. Moss and J. B. Rae Dec. 1968 19 p refs
(AERE-R-5876) Avail: CFSTI; UK 3s 6d

An automatic machine was constructed to count proton-recoil tracks in nuclear emulsions used as personal dosimeters for fast neutrons. The machine uses an optomechanical fast scanning arrangement to examine 0.8 cu. mm. of emulsion in 12 minutes. A maximum number of 60 track plates can be automatically examined in 12.5 hours. To discriminate between proton tracks and aggregates of grains in the emulsion, it is necessary to ignore track lengths less than 5 μm, corresponding to 0.5 MeV protons. The energy response shows reasonable agreement with that expected by calcuation, and calibration of the dosemeter/reader combination by Pu–Be neutrons gave a linear relationship up to 4.5 rem, with a background of 0.1 rem. Author (NSA)

N69-34522# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
STRATEGY AND TECHNIQUES FOR SOLVING THE TWO-DIMENSIONAL MULTIGROUP DIFFUSION EQUATION
R. W. Hardie and W. W. Little, Jr. 1 Oct. 1968 5 p refs Presented at Conf. on the Effective Use of Computers in the Nucl. Ind., Knoxville, Tenn., 21-23 Apr. 1969
(Contract AT(45-1)-1830)
(BNWL-SA-2164; CONF-690401-2) Avail: CFSTI

Techniques for solving the spatial flux in fast reactor multi-group diffusion equations are described. Use of line inversion with tight mesh spacing for obtaining group-flux profiles is discussed. Effects of the various acceleration schemes on computer time are tabulated. NSA

N69-34523# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
MOLECULAR DYNAMICS STUDIES BY NEUTRON INELASTIC SCATTERING AND COMPETING METHODS
Jerzy A. Janik Apr. 1968 57 p refs
(INP-600/PS) Avail: AEC Depository Libraries

The subject "molecular dynamics" is discussed in this paper stressing two points: (1) understanding of the process of neutron scattering by molecules of a gas or by what is called molecular groups in solids and liquids; and (2) obtaining information concerning molecular motions from neutron inelastic scattering experiments and compering them with those obtained from other methods. Substances with hydrogen bonds such as: ice, water, hydrates are discussed as examples, and also typically molecular substances, for instance, methane in various phases. Author (NSA)

N69-34527# Massachusetts Inst. of Tech., Cambridge.
INELASTIC NUCLEAR ELECTRON SCATTERING IN THE INDEPENDENT PARTICLE MODEL
Taber De Forest, Jr. Orsay, France Paris Univ. Jan. 1969 31 p refs
(LAL-1208) Avail: AEC Depository Libraries

The quasi-elastic model of nuclear electroexcitation was generalized to include the effects of binding and the distortion of the wave function of the emitted nucleon by energy-dependent nuclear potential. The model predicts cross sections which are in good agreement with the inelastic spectra observed in ^{12}C experiments. For ^{16}O, however, the experimental cross sections are larger than predicted, especially for small energy transfers. This may be due to correlations associated with multi-particle-hole excitations which are not included in the model. The inclusion of the Perey effect, which is necessary to guarantee the usual electron scattering sum rules, was found to be very important, reducing the cross sections by 30% to 40%. Author (NSA)

N69-34541*# Ling-Temco-Vought, Inc., Dallas, Tex.
AN EXPERIMENTAL STUDY OF ELECTRON TRANSMISSION AND BREMSSTRAHLUNG PRODUCTION
D. H. Rester Washington NASA Aug. 1969 143 p refs
(Contract NAS8-21055)
(NASA-CR-1383; Rept-0-71100/9R-1) Avail: CFSTI CSCL 08H

Measurements of electron bremsstrahlung cross sections at an incident electron energy of 60 KeV with a Ge (Li) spectrometer are included in this report. A determination of electron electron bremsstrahlung yields from cross section measurements on Be, for which the electron electron component of the total bremsstrahlung yield is large is also reported. Measurements of electron transmission of Al and Au targets for normal incidence of the

electron beam at a bombarding energy of 2.5 MeV are described, and studies of electron transmission for a cosine law source and measurements electron bremsstrahlung production for non normal incidence. Collectively, these experiments adequately describe the electron interactions in matter in the low to intermediate energy range considered to be of importance for comparison to computations of electron transport and bremsstrahlung production. Author

N69-34543# Bayerische Akademie der Wissenschaften, Munich (West Germany). Zentralinstitut fuer Tieftemperaturforschung.
INFLUENCE OF NEUTRON RADIATION AT 4.6°K ON THE SUPERCONDUCTING PROPERTIES OF NIOBIUM [EINFLUSS VON NEUTRONENBESTRAHLUNG BEI 4.6°K AUF DIE SUPRALEITUNGSEIGENSCHAFTEN VON NIOB]
H. Berndt, N. Kartascheff, and H. Wenzl Sep. 1968 45 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-68-43) Avail: AEC Depository Libraries

The magnetization properties and the electrical resistivity of niobium have been studied as a function of neutron irradiation at 4.6°K and subsequent annealing treatment. A magnetic hyteresis with dominant peak effect near H_{c2} was induced by the neutron irradiation. The upper critical field H_{c2} increased linearly with the normal resistivity ρ_n in agreement with theory. The pinning force f_p exerted by the defect clusters on the flux lines reveals a maximum ($f_p \cdot 10^{-3}$ dyn/cm) at a dose of $\phi t \sim 3.10^{18}$ neutrons/cm^2. The residual resistivity shows a tendency toward saturation with irradiation. Author (NSA)

N69-34544# Scientific Translation Service, Ann Arbor, Mich.
COMPUTING PROCESS FOR INTRANUCLEAR CASCADES
V. S. Barashenkov et al [1969] 14 p refs Transl. into ENGLISH of JINR, Lab. of Theoret. Phys. report JINR-P2-4065 Prepared for ORNL
(ORNL-tr-2130; JINR-P2-4065) Avail: CFSTI

A detailed description of a scheme for calculating intranuclear cascades by means of the Monte Carlo method is given. This proposed computing scheme is applicable only to accelerating energies not exceeding several 10 GeV. The scheme was tested on a large number of different cases and found to be very effective even when using relatively small computers. The nucleus is viewed as a Fermi gas of nucleons enclosed in the nuclear space. NSA

N69-34545# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
THE MESOTRON, AN ELECTRON ACCELERATOR FOR HIGH FINAL ENERGIES [DAS MESOTRON, EIN ELEKTRONENBESCHLEUNIGER FUER HOHE ENDENERGIEN]
G. Bathow, E. Freytag, and H.-O Wuester Dec. 1968 17 p refs In GERMAN; ENGLISH summary
(DESY-68/58) Avail: CFSTI

The circular electron accelerator described is characterized by the following properties: the energy gain per turn is an appreciable fraction of the final energy; thus the electrons perform only a small number of turns, electrons in different turns are simultaneously accelerated in linear accelerator structures, and electrons of different energies are focussed on separated orbits; thus dc-powered magnets may be used in the circular sections. Comparison of the proposed accelerator with the conventional synchrotron and the linear accelerator is made and the possible advantages are discussed. The use of superconducting acceleration structures would allow a duty-cycle of 100%. In this case the proposed accelerator is expected to have economical advantages compared to a superconducting linear accelerator of the same duty-cycle for energies up to approximately 60 GeV. Finally, the possible application for proton acceleration is pointed out. (NSA)

N69-34560# Kernforschungszentrum, Karlsruhe (West Germany)
A MONTE-CARLO PROGRAM FOR RECOIL PROTON COUNTERS WITH CYLINDRICAL GEOMETRY
V. Brandl Oct. 1968 30 p refs In GERMAN
(KFK-860, EUR-4154.d) Avail: AEC Depository Libraries

The principles and the description of a Monte-Carlo program for the IBM-7074 for the evaluation of neutron spectrum measurements with proton-recoil counters were presented. The method for the evaluation of neutron spectrum measurements is based on the fact that one can with the help of the recoil-proton spectrum measurements calculate the actual recoil proton spectrum. In the development of the program the following simple assumptions were made: The collision sites in the cylindrical counter are equally distributed, each neutron collides in the cylinder only once, and the angular distribution of the recoil protons is isotropic in the center of gravity system. The program permits the calculation of the spectra for neutron incidence parallel to the cylinder axis and for isotropic neutron fluxes. The results of some calculations with varied input parameters were given. NSA

N69-34561# California Univ., Berkeley. Lawrence Radiation Lab.
THE DELTA K EQUALS 1 ELECTRIC DIPOLE TRANSITIONS IN ODD-MASS DEFORMED NUCLEI. 1. THE DECAY OF Ta-176 TO LEVELS IN Hf-176. 2
Frederick Michael Bernthal (Ph.D. Thesis) Feb. 1969 340 p refs
(Contract W-7405-eng-48) Avail: CFSTI
(UCRL-18651) Avail: CFSTI

Attention was focused on the uniquely informative set of E1 transitions in ^{177}Hf that results from decay of the singular ^{177m}Lu nucleus. It is shown that the influences of Coriolis coupling, pairing, and octupole vibration-particle coupling may be used to successfully account for the anomalous E1 transition rates in ^{177}Hf, and by implication, in other odd-A deformed nuclei. A detailed experimental study of the decay of ^{176}Ta to levels in ^{176}Hf was performed. Numerous semiconductor detection systems were employed in conjunction with an on-line PDP-7 data acquisition system to gather γ-ray singles, conversion electron, and γ-γ coincidence data on this remarkably complex decay. Attention is also called to the exceptional quantity and quality of information on nuclear properties that can now be expected from the timely marriage of semiconductor-detector and on-line computer technology. The techniques and problems associated with precision γ-ray spectroscopic data acquisition and analysis are discussed. Author (NSA)

N69-34562# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
EFFECT OF THE ORGANIC DILUENT ON TLA EXTRACTION OF Pu(IV) FROM NITRIC ACID MEDIUM
J. Koehly and R. Berger [1967] 12 p refs Presented at the 11th Intern. Conf. on Coord. Chem., Haifa and Jerusalem, Israel
CEA-CONF-1267; CONF-680912-3) Avail: AEC Depository Libraries

The effects of various diluents on the extraction of Pu^{4+} by tridodecylammonium and methyltridodecylammonium nitrates were investigated. The Pu^{4+} distribution coefficients between the tertiary or quaternary ammonium salts and nitric acid solutions were measured by alpha counting. NSA

N69-34567# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
INELASTIC SCATTERING OF AN ELECTRON BY A NONMAGNETIC IMPURITY IN A CRYSTAL
Shozo Takeno Jun. 1969 37 p refs
(RIFP-87) Avail: CFSTI

A formal study is made of the inelastic scattering of an electron by a localized imperfection in a crystal lattice. By use of the tight-binding approximation, the scattering cross section is calculated with particular attention paid to taking into account the change of the energy spectrum of phonons as well as that of the electron upon introduction of a nonmagnetic, substitutional impurity atom into the crystal. The inelastic scattering cross section describing one-phonon processes is expressed in terms of secular determinants giving energy eigenvalues of both electronic and vibrational impurity states. It is shown that when the phonon system is strongly perturbed by the impurity, inelastic scattering processes play an important role under certain circumstances. This is particularly so when the impurity gives rise to both low-frequency vibrational and electronic resonant states. Emphasis is placed on the role of low-frequency resonant phonon modes, by which the electron is shown to be scattered predominantly. Author

N69-34572# Rochester Univ., N.Y. Nuclear Structure Research Lab.
THE MEASUREMENTS OF ELECTRIC MOMENTS BY HIGHER ORDER COULOMB EXCITATION
D. Cline Jul. 1969 34 p refs Submitted for publication
Supported by NSF
(UR-NSRL-22)

Static electric moments of a nuclear level related to the shape of the nucleus were measured by observing the interaction of the moment with an electric field gradient. In Coulomb excitation, the electric field gradient was produced by the charged projectile as it passes the target nucleus. The major assumption presented is that the the nuclei are far enough apart to ensure that the interaction is purely electromagnetic. The reorientation effect was assessed by measuring the excitation probability as a function of scattering angles for a fixed projectile and by using a constant geometry and varying projectile type. The reorientation effect in cadmium 114 is discussed. J.A.M.

N69-34576# Aktiebolaget Atomenergi, Studsvik (Sweden).
HALF-LIFE MEASUREMENTS OF LEVELS IN ^{75}As
Sven G. Malmskog and Mats Höjeberg (Stockholm Univ.) Apr. 1969 15 p refs Submitted for publication
(AE-357) Avail: CFSTI

Half-lives for three levels in ^{75}As have been determined using an electron-electron coincidence spectrometer. The following results have been obtained. $T_{1/2}$(199 keV) = 0.87 ± 0.03 nsec, $T_{1/2}$(280 keV) = 0.28 ± 0.02 nsec and $T_{1/2}$(401 keV) = 1.67 ± 0.14 nsec. Author (ESRO)

N69-34577# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
CONTRIBUTION TO THE STUDY OF NEUTRON-NEUTRON INTERACTIONS USING THE THREE NEUCLEON EXPERIMENT D(n,nnp) AT 14.6 MeV: EVALUATION OF PARASITIC EVENTS [CONTRIBUTION A L'ETUDE DE L'INTERACTION NEUTRON-NEUTRON A L'AIDE DE L'EXPERIENCE A TROIS NUCLEONS D(n,nnp) A 14,6 MeV: EVALUATION DES EVENEMENTS PARASITES]
Claude Ducharme (Ph.D. Thesis-- Grenoble Univ., 10 Jul. 1968) Apr. 1969 87 p refs In FRENCH; ENGLISH summary
(CEA-R-3726) Avail: CFSTI

This report is related to the interpretation of the three nucleon experiment, D(n, nnp), at 14.5 MeV, carried out by double time-of-flight spectrometry. It consists in simulation of the main parasitic events and uses the Monte-Carlo method for extracting them from the experimental distribution around the n-n pole. Author (ESRO)

N69-34582# Atomic Power Development Associates, Inc., Detroit, Mich.
AEC-SPONSORED ACTIVITIES Quarterly Technical Progress Report, Oct. - Dec. 1968
Dec. 1968 44 p refs
(Contract AT(11-1)-865)
(APDA-234) Avail: CFSTI

The following topics are reported on: measurements of sodium-induced wastage of tubes(boilers) for LMFBR, a description of the loop and apparatus for determining the hydrogen content in LMFBR coolant sodium, wastage measurements on steam generators, oxygen meters, and plugging meters of LMFBR mock-ups, and sodium purity control, coolant analysis, and a description of oscillating plugging meter for determining sodium purity. NSA

N69-34587# California Univ., Livermore. Lawrence Radiation Lab.
EXPERIMENTAL STUDY OF 50-50 Ni-Fe TAPE-WOUND MAGNETIC CORES FOR THE ASTRON ACCELERATOR
Gary G. Berger 1 Apr. 1969 9 p ref Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N. Mex., 8-11 Apr. 1969 Sponsored by AEC
(UCRL-71553; CONF-690407-5) Avail: CFSTI

Two of the fundamental limitations on the Astron accelerator have been the poor quality and uniformity of pulse properties in the accelerator cores. An experimental and theoretical study to improve these properties was undertaken. The primary goal of the study was to determine which parameters affect the excitation current of a 1-mil tape-wound core when it is energized by kilovolt pulses. The most significant conclusion from the research is that eddy currents form the dominant component of excitation current. Furthermore, eddy currents in several adjacent, poorly insulated turns of tape seem to be the prime cause of the lack of quality and uniformity of cores. Following this core study, an order for 266 cores was placed, and for the first time, manufacturers had the knowledge to respond to performance specifications. Author (NSA)

N69-34588# California Univ., Berkeley. Lawrence Radiation Lab.
PIONIC ATOMS
Arthur Raymond Kunselman Apr. 1969 84 p refs Sponsored by AEC
(UCRL-18654) Avail: CFSTI

The x rays produced by negative pions stopped in various targets were measured. The line shifts, line widths, and line intensities in pure element targets were measured to observe the effect of the pion--nuclear strong interaction. An optical-model analysis for the shifts and widths is presented. The line intensities in chemical-compound targets were measured to observe the effects of the chemical composition of the target on the probability of pion capture by the constituents. Germanium solid-state detectors were used throughout. Author (NSA)

N69-34596# Technische Univ., Berlin (West Germany). Institut fuer Kerntechnik.
RADIATION MEASUREMENT TECHNIQUE

U. Weeser, L. Metzger, and H. W. Krenzer May 1968 288 p refs In GERMAN, ENGLISH summary
(TUBIK-9) Avail: AEC Depository Libraries

These lecture notes are to be used for preparation of experimental course at the Lehrstuhl und Institut für Kerntechnik at the Technical University Berlin. They shall give students basic knowledge on radiation and application of equipment for measurements. The covered items are: radioactivity; interaction of neutrons with matter; α, β, and γ radiation; radiation protection; detectors; error statistics; and examples of radiation measurements. Author (NSA)

N69-34597# Scientific Research Atomic Reactor Inst., Melekess (USSR).
IRRADIATION DIFFUSION FACTORS ESTIMATE [OTSENKA KOEFFITSIENTON DIFFUZII PRI OBLUCHENII]
V. M. Raetskii and A. S. Pokrouskii 1968 14 p refs In RUSSIAN
(SRAPI-P-28) Avail: AEC Depository Libraries

Expressions were found for radioinduced diffusion capacities for U and Ni as a function of neutron flux, the mean discharge distance, and temperature at vacancy concentration less than 10^{-5}. At low temperature the radiation induced vacancies determine the diffusion mobility. The direction of the vacancy flux may influence the distribution of alloying elements and gas atoms in irradiated materials. NSA

N69-34599# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuetron Physics.
INTERFERENCE EFFECTS IN THE CROSS SECTION OF THE RADIATIVE CAPTURE OF A NEUTRON BY Sm 149 NUCLEUS
I. V. Kirpichnikov, E. Z. Ryndina, and J. Urbanec 1969 12 p refs In RUSSIAN
(JINR-P15-4325) Avail: AEC Depository Libraries

The cross sections of the radiative neutron capture with excitation of the ^{150}Sm nucleus levels E = 5.53 and 7.21 MeV were measured using a Ge(Li) detector in the neutron energy interval from 0.12 to 1.5 eV. For explaining the observed energy dependences of the cross section, it is necessary to assume the existence of positive (constructive) interference between the first two resonance levels in the cross section. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-33202*# California Univ., Los Angeles. Plasma Physics Group.
PARAMETRIC MODE-MODE COUPLING BETWEEN DRIFT WAVES IN PLASMAS
Francis Hai and Alfred Y. Wong Jan. 1969 67 p refs
(Grant NGR-05-007-066)
(NASA-CR-103792; R-40) Avail: CFSTI CSCL 20I

The nonlinear phenomenon of parametric excitation of stable resonant drift modes through mode-mode coupling is examined in the potassium plasma of a Q device. The scheme investigated extensively is the degenerate case of three-mode parametric coupling in which the stable resonant mode (m = 1) at ω_1 is excited by the externally driven pump mode (m = 2) at $\omega_0 = 2\omega_1$. The usual frequency and wave number matching conditions are satisfied. The additional, new aspects examined are the enhancement of thermal fluctuations, the threshold for excitation, and the power balance between the coupled modes and the external source. The main results obtained are the measurement of the coupling coefficient and the determination of the functional behavior of the modes. To describe the steady state amplitudes observed experimentally, nonlinear saturation phenomena are included. Nondegenerate and higher order coupling schemes are briefly considered. Parametric coupling as a mechanism limiting the amplitude of an unstable mode and leading to a turbulent plasma is presented and discussed. Author

N69-33282*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FIELD AND PLASMA IN THE LUNAR WAKE
Y. C. Whang (Catholic Univ. of Am.) Jul. 1969 29 p refs
(Grant NGR-09-005-063)
(NASA-TM-X-63624; X-616-69-318) Avail: CFSTI CSCL 20I

A theory is presented to explain the observed variations of the magnetic field and plasma in the vicinity of the moon. Under the guiding-center approximation, solutions for the plasma flow near the moon are obtained from the kinetic equation. The creation of a plasma cavity in the core region of the lunar optical shadow disturbs the interplanetary magnetic field. Maxwell's equations are used to study perturbations of the magnetic field in the lunar wake. The acceleration drift current, which was omitted from the earlier work, is included in the present theory in the calculation of the total electric current in the lunar wake. When the interplanetary magnetic field lines penetrate into the lunar body, due to sudden change of magnetic permeability the magnetic field is disturbed at the lunar limbs. Propagations of this disturbance with magnetoacoustic speed form a Mach cone downstream. Perturbations of the magnetic field are restricted to the region inside the Mach cone; the region outside remains undisturbed. The numerical results agree extremely well with experimental data from the Explorer 35 spacecraft. Author

N69-33418*# City Univ. of New York.
FLUCTUATION THEORY OF AMBIPOLAR DIFFUSION IN A MAGNETO-PLASMA
C. M. Tchen [1969] 4 p
Grant NGR-33-013-034)
(NASA-CR-103790) Avail: CFSTI CSCL 20I

Weakly ionized plasmas in a strong magnetic field and small fluctuations are given consideration in this theory. The results show that the theory is valid for plasmas in large scale turbulent motion, and where such a turbulence ceases and is replaced by microdisturbances. The hydrodynamic equations, transport coefficients, and equations of motion are submitted in proof of the theorem. E.H.W.

N69-33499# Los Alamos Scientific Lab., N. Mex.
PROCEEDING OF THE APS TOPICAL CONFERENCE ON NUMERICAL SIMULATION OF PLASMA
30 Sep. 1968 162 p refs Conf. held 18-20 Sep. 1968
(Contract W-7405-ENG-36)
(LA-3990) Avail: CFSTI

The numerical simulation of plasma is discussed in terms of electrostatic waves, high beta plasmas, and low beta plasmas. For individual titles, see N69-33500 through N69-33522.

N69-33500# Princeton Univ., N.J. Plasma Physics Lab.
A FINITE-SIZE PARTICLE MODEL FOR PLASMA SIMULATION

J. M. Dawson, C. G. Hsi, and R. Shanny (GE, Philadelphia) *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 10 p refs (See N69-33499 19-25)
(Contract AT(30-1)-1238; Grant NSF GP-579)
Avail: CFSTI

A finite-size particle model is being developed for plasma simulation in one, two, and three dimensions. The particles have a Gaussian distribution of charge. These clouds pass freely through each other but no internal motion is allowed. This model suppresses the short-wavelength field fluctuations which give rise to collisional effects while correctly modeling the long-wavelength collective modes. A code was developed for the one-dimensional case and the results are compared with earlier ones from the sheet model. Excellent agreement is found for particles with radii up to one Debye length and general agreement is found for even larger particles. The model is being extended to two and three dimensions. The use of particles with different charges, but with the same charge-to-mass ratio is considered. Such a model behaves the same as far as the Vlasov equation is concerned. This extension will allow the bulk of the plasma to be simulated by a few particles with large charges, while a large number of particles with a small charge on each may be used to represent the most interesting regions of phase space. Author

N69-33501# Princeton Univ., N.J. Plasma Physics Lab.
INVESTIGATIONS OF ELECTROSTATIC OSCILLATIONS OF A NON-MAXWELLIAN PLASMA
R. Shanny (GE, Philadelphia), W. L. Kruer, and J. M. Dawson *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 7 p refs (See N69-33499 19-25)
(Contract AT(30-1)-1238; Grant NSF GP-579)
Avail: CFSTI

The electrostatic sheet model was used to investigate (1) the finite-amplitude oscillations of a plasma with a Maxwellian velocity distribution plus a large flat tail, and (2) the driven oscillations of an initially Maxwellian plasma. For the first problem the dispersion relation shows that there are two branches for ω for a given k. Beating between two waves was observed and it checks with theory. The existence of two branches allows for resonant mode coupling, and some evidence for this was seen. However, other nonlinear processes, such as those associated with trapped particles, may be important and further work is required to sort out the important effects. In the second problem a forcing term of the form $\sin(kx - \omega t)$ was applied to an initially Maxwellian plasma. Here the resonant wave grew to large amplitudes, pulling out a long tail on the distribution. The plasma continued to heat (gain energy) to the end of the run. For strong driving, a second bump formed in the distribution. Waves with nearby phase velocity (nonresonant and nonharmonic waves) grew to large amplitudes. Author

N69-33502# Kansas Univ., Lawrence.
NUMERICAL STUDIES OF NONLINEAR ION ACOUSTIC WAVES
T. P. Armstrong and D. Montgomery (Iowa Univ.) *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 6 p refs (See N69-33499 19-25)
Avail: CFSTI

The nonlinear Vlasov equation for ions coupled with a fluid model for the neutralizing electrons was integrated numerically. Collisionless damping of ion acoustic waves was observed in the model. The characteristics of the damping of large amplitude waves are qualitatively similar to experimental observations as well as to prior numerical calculations on the damping of electron plasma oscillations. Namely, the initial damping is more severe than that expected from linearized theory and the long time regime has smaller than the linear damping rate. Author

N69-33503# Los Alamos Scientific Lab., N. Mex.
NUMERICAL SIMULATION OF WARM TWO-BEAM PLASMA
R. L. Morse and C. W. Nielson *In its* Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 10 p refs (See N69-33499 19-25)
Avail: CFSTI

One-dimensional numerical simulation of plasmas consisting of two unequal warm beams has shown flattening of the small beam and, in most cases, a strong single mode structure at about the wavelength of largest linear growth rate, accompanied by an eddy-like arrangement of trapped particles in phase space. The total electrostatic field energy first increases at the linear growth rate and then, after saturating abruptly, decreases at about the same rate to an intermediate level where a much slower decay begins. Author

N69-33504# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
NUMERICAL STUDY OF CHARGED PARTICLE HEATING BY PLASMA TURBULENCE
S. Peter Gary and David Montgomery *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 8 p refs (See N69-33499 19-25)
(Grant NGR-16-001-043)
Avail: CFSTI CSCL 20I

Numerical calculations of the heating of charged particles by turbulent electric fields are reported. The fields are given, and are not required to be self-consistently supported by the particles. Three types of wave spectra are treated, each of which is analytically unmanageable: (1) many waves, constant phases and velocities; (2) one wave, randomly interrupted phase; and, (3) one wave, slowly varying wave number at constant frequency. Large particle energization is found in the last two cases. In all three cases, the results can be qualitatively understood by elementary arguments related to particle trapping. Author

N69-33505# Kansas Univ., Lawrence.
PERSISTENTLY RECURRING NONLINEAR WAVES ARISING FROM THE TWO STREAM INSTABILITY
T. P. Armstrong and J. P. Freidberg (Los Alamos Sci. Lab.) *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 9 p refs (See N69-33499 19-25)
Avail: CFSTI

The full nonlinear cold plasma equations were solved numerically for a counterstreaming electron-ion plasma. A class of linearly unstable longitudinal electrostatic waves which stabilize nonlinearly before particle overtaking occurs was found. These waves occur in periodic systems where the boundaries are open circuited and only one wave number (in the neighborhood of the instability boundary) is linearly unstable. Relevant existing analytical theories are briefly reviewed, and the formulation of a new theory suggested by the numerical data is outlined. Author

N69-33506# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
DYNAMICS OF INHOMOGENEOUS PLASMAS

H. M. Schneider and A. Bers *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 16 p refs (See N69-33499 19-25)
(Grant NSF GK-2581)
Avail: CFSTI

Small but finite amplitude excitations of an inhomogeneous plasma generate large amplitude charge density oscillations and nonlaminar motions of the plasma particles. The details of this nonlinear and nonlaminar motion can best be studied by a computer simulation of the dynamics of the plasma. The results of both small and large amplitude excitations of a plasma with a smooth density profile are presented. The transition from linear to nonlinear oscillations is discussed and the conditions for the onset of nonlaminar motions are given. It is shown that for small amplitude excitations a linearized Lagrangian description correctly predicts the detailed dynamics up to the time that overtakings occur. The Eulerian description can only be used to describe averaged field quantities such as the voltage across the plasma. For large amplitude excitations the dynamics are soon dominated by nonlaminar effects which lead to a thermalization of the energy imparted to the plasma by the initial excitation. Author

N69-33507# Los Alamos Scientific Lab., N.Mex.
NUMERICAL INVESTIGATION OF THE TWO-STREAM INSTABILITY VIA HAMILTON'S PRINCIPLE
H. Ralph Lewis and K. J. Melendez *In its* Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 4 p refs (See N69-33499 19-25)
Avail: CFSTI

A new numerical method is used to investigate the instability of two cold streams in a periodic, one-dimensional plasma consisting of a single species with a fixed neutralizing background. The plasma is treated in the Vlasov approximation, and the starting equations are Poisson's equation and the equation of motion that determines the trajectory of each of the infinite number of particles present in one spatial period of the plasma. The solution of the particle equation of motion is represented approximately by a linear combination of a finite number of basis functions of the initial position and velocity of the particle with time-dependent coefficients. Similarly, the scalar potential is represented approximately by a linear combination of a finite number of basis functions of position with time-dependent coefficients. The quantities to be determined are the time-dependent coefficients. The equations governing the time evolution of these coefficients are determined uniquely and directly from Hamilton's principle, and they are solved numerically by a standard technique. Author

N69-33508*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPROACH TO EQUILIBRIUM FOR A COLLISIONLESS SYSTEM
Frank Hohl *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 8 p refs (See N69-33499 19-25)
Avail: CFSTI CSCL 20I

One-dimensional computer models are used to simulate the evolution of collisionless plasmas and self-gravitating systems. The evolution for various initial distributions is investigated. It is found that for simple initial conditions the quasi-equilibrium state which is reached after several plasma periods is close to the Fermi distribution proposed by Lynden-Bell. For more complicated initial conditions the Lynden-Bell distribution does not adequately describe the final state of the system. Author

N69-33509# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
ON ONE-DIMENSIONAL INITIAL VALUE PROBLEMS WITH A TRANSVERSE MAGNETIC FIELD
Cathleen S. Morawetz *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 5 p refs (See N69-33499 19-25)
Avail: CFSTI

A charge neutral collision free plasma is studied numerically. First and second moments are taken of the collision free one-dimensional time dependent Vlasov equations coupled with Maxwell's equations using the condition of charge neutrality instead of Poisson's equation. Conditions are investigated under which (a) an asymptotic adiabatic formula may be used for the electrons and (b) the third moments of the ions may be neglected. The resulting system is solved numerically for certain initial and boundary value problems with two point accuracy. The neglected third moments are computed using 8000 particles and shown to be negligible. It is shown that as the pressure of the gas increases the strength of a breaking disturbance decreases rapidly. Author

N69-33510# Los Alamos Scientific Lab., N.Mex.
NUMERICAL SIMULATION OF AXI-SYMMETRIC, COLLISIONLESS, FINITE BETA PLASMA
D. O. Dickman, R. L. Morse, and C. W. Nielson *In its* Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 16 p refs (See N69-33499 19-25)
Avail: CFSTI

A numerical simulation method for time dependent, axi-symmetric collisionless, finite β plasma is described and applied to mirror modes in θ-pinches and to rotational and tearing modes in Astron. It is shown that the mirror modes cause an increase of axial thermal velocities and the long time development of a gross bumpy structure in the θ-pinch plasma. The Astron plasma layer first develops tearing modes in agreement with linear theory, but at later times the wavelength of this mode increases by coalescence until the plasma is completely reassembled. Author

N69-33511# Los Alamos Scientific Lab., N.Mex.
TWO DIMENSIONAL SIMULATION OF SHOCK WAVES IN COLLISIONLESS PLASMAS
Carl R. Shonk and Richard L. Morse Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 11 p refs (See N69-33499 19-25)
Avail: CFSTI

Analytical approaches to the calculation of collisionless shock waves are discussed. Difficulties prevalent in these calculations can be avoided by numerical simulation, since plasma particle interactions are simple and well known. In the model, ions move correctly under self-consistent fields. Electrons are treated as a massless, adiabatic fluid which moves so as to maintain charge neutrality to lowest order. Ion motion is non-adiabatic due to interaction with the turbulent fields in the plasma. Particle motion is in a plane perpendicular to the magnetic field. A suitable set of finite difference equations for the particle motion is proposed, and their solution by a particle-in-cell technique is discussed. Author

N69-33512# Columbia Univ., New York.
CONSERVATIVE DIFFERENCE SCHEMES FOR THE FOKKER PLANCK EQUATION
James Whitney *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 8 p refs (See N69-33499 19-25)
(Grant NSF GK-1258)
Avail: CFSTI

A numerical scheme which insures conservation of mass, momentum, and energy is developed for solution of the Fokker–Planck kinetic equation. As an example of the method, the long time thermal relaxation of a deuterium-electron plasma is computed. Author

N69-33513# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.

SOLUTION OF FREE BOUNDARY PROBLEMS BY THE METHOD OF STEEPEST DESCENT

Eugene Bloch and Paul Garabedian *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 4 p (See N69-33499 19-25)

Avail: CFSTI

A systematic iterative scheme for the numerical solution of steady free boundary problems of fluid dynamics and plasma physics by the method of finite differences was developed. The scheme uses paths of steepest descent associated with familiar variational principles to specify an artificially time-dependent formulation of the problem that is readily handled numerically. A new technique of conformal mapping enables us to determine the shape of the free boundary by means of difference equations over a fixed rectangle. The method is applicable to a variety of models involving just two independent variables. Author

N69-33514# Los Alamos Scientific Lab., N.Mex.

MHD SIMULATION OF CO-AXIAL PLASMA FLOW

T. D. Butler, J. L. Cook, and R. L. Morse *In its* Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 8 p refs (See N69-33499 19-25)

Avail: CFSTI

The results of a numerical simulation of a co-axial plasma gun operating in the puffed gas mode are reported. A compressible MHD model is used. A wake shock is seen to form on the axis downstream from the center electrode. The heated plasma inside the shock shows a dual structure; a hot inner core is surrounded by a cooler region just inside the shock. A quasi-continuous flow pattern is seen to develop. Author

N69-33515# Sandia Corp., Albuquerque, N.Mex.

INITIAL RESULTS FROM A TWO-DIMENSIONAL LAX-WENDROFF HYDROMAGNETIC CODE

J. R. Freeman and F. O. Lane, Jr. *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 8 p refs Supported by AEC (See N69-33499 19-25)

Avail: CFSTI

The success of a number of one-dimensional hydromagnetic codes in predicting the gross dynamical behavior of a variety of plasma devices has led to an attempt to extend the calculations to two dimensions. An explicit Eulerian difference scheme of the Lax–Wendroff variety was chosen to provide a reasonable level of accuracy for a relatively coarse space-time net. A staggered array with provision for fixed regions of fine zoning was used. Numerical stability was achieved by using a third-order smoothing technique reported recently by Lapidus. All calculations assumed currents which were directed solely in the theta direction. A simple two-dimensional high density theta pinch, incorporating a mirror field at the ends, was chosen as a test example. The hydromagnetic equations included the effects of thermal conduction and a temperature dependent electrical conductivity. Author

N69-33516# Los Alamos Scientific Lab., N.Mex.

EARLY RESULTS FROM A TWO-DIMENSIONAL DRIFT EQUATION SIMULATION

David S. DeYoung *In its* Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 3 p refs (See N69-33499 19-25)

Avail: CFSTI

Some results of a two-dimensional axisymmetric plasma simulation code are presented, in particular the end loss from a high beta theta pinch and the simulation of astronomical objects. A brief discussion of the code, which employs the first order drift equations and invariant magnetic moments, is given. Author

N69-33517# California Univ., Livermore. Lawrence Radiation Lab.

CLOUD-IN-CELL COMPUTER EXPERIMENTS IN TWO AND THREE DIMENSIONS

C. K. Birdsall and D. Fuss *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 8 p refs (See N69-33499 19-25)

Avail: CFSTI

Simulation of fusion plasmas with particle forces dominated by electrostatic fields in applied B fields is the major application of our cloud-in-cell approach [1], CIC. The charged particles (clouds) have finite size and can pass through one another; they obey a Coulomb force law when separated and a linear force law when overlapping, allowing simple harmonic (plasma) oscillation at small separation. Uniform density square clouds are used in 2D and cubic clouds in 3D. The object was to reduce some of the spurious short wavelength, high frequency effects produced in the zero-size-particle, nearest-grid-point method; some reduction was achieved, as shown in comparison runs. SQRPLA with zero potential boundaries in a 48x48 grid, was applied to diocotron, and loss cone distribution problems with excellent energy conservation at low densities, degrading to good at high densities. CUBPLA, with a 36x36x36 grid, was run but sparingly, awaiting evolution of improvements in initial conditions and diagnostics in our more easily handled and economical 1D and 2D CIC codes. Author

N69-33518# California Univ., Berkeley.

THEORY AND EXPERIMENTS FOR A PLASMA CONSISTING OF CLOUDS INTERACTING WITH CLOUDS (CIC) WITH AND WITHOUT A SPATIAL GRID

C. K. Birdsall, A. B. Langdon, C. F. McKee, H. Okuda, and D. Wong *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 8 p refs (See N69-33499 19-25)

(Contract AT(11-1)-34)

Avail: CFSTI

A theory for our computer plasma model which uses charged clouds (CIC, either cloude-in-cells or clouds-interacting-with-clouds) was developed. The major effects of and reasons for using finite size particles are to suppress interactions at wavelengths smaller than the cloud thickness and to reduce the noise at high frequencies enhanced by particle and grid crossings. These reductions were observed in 1, 2, and 3D experiments. Our object is to predict and measure these effects in some detail and to begin understanding the more difficult problem of the remaining unphysical noise due the use of grids and small numbers of particles in plasma simulation. The beginnings of plasma cloud theory with computer verification of some results are presented, mostly in one dimension, with and without grids. The problems studied include the interaction force; many particle cold plasma oscillations; warm (Vlasov) plasma linearized dispersion relation; shielding; and field fluctuations in equilibrium. Author

N69-33519# California Univ., Livermore. Lawrence Radiation Lab.
REDUCED SPACE MODELS FOR COMPUTER SIMULATION OF PLASMA MICROINSTABILITIES
J. A. Byers and M. Grewal *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep 1968 5 p refs Sponsored by AEC (See N69-33499 19-25)
Avail: CFSTI

Arbitrary restriction of the spatial configuration to less than three dimension allows one to focus the resolving power of the computer on the details of the velocity distribution. This technique, first developed in one dimension by Hasegawa and Okuda, allows one to examine complicated problems that involve both gyro motion perpendicular to the magnetic field, B, and also motion along B. The technique is to simply restrict the wave vector, k, to less than three dimensions and demand exact uniformity of all quantities in the direction(s) perpendicular to the allowed K. One thus transforms the particles into sheets for one dimensional models, and into rods for two dimensional models. The full three dimensional model applied to an infinite medium $k_{\parallel} = 0$ mode, where the instability arises due to the monoenergetic perpendicular velocity distribution. The instability can be clearly observed above the fluctuation noise, and growth to saturation is very rapid, occuring in approximately $5 - 10\ \omega_{ci}^{-1}$, roughly consistent with the linear theory. The maximum attainable electric field energy is only approximately 5% of the plasma kinetic energy. The velocity distribution spreads very rapidly into a state which is stable according to linear theory, but long time wave fluctuation effects persist. Author

N69-33520# Princeton Univ., N.J. Plasma Physics Lab.
A FLUID DESCRIPTION FOR TOROIDAL LOW-β CONFINEMENT
John L. Johnson, Niels K. Winsor, and John M. Dawson *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 5 p refs (See N69-33499 19-25)
(Contract AT(30-1)-1238; Grant NSF GP-579)
Avail: CFSTI

A computer program is being developed to study the confinement of low-β plasmas in simple axially symmetric configurations from the fluid point of view. The equations contain the effects of resistivity, plasma inertia, the Hall term, and pressure gradients along the magnetic field lines, and will be generalized to include viscous and gyroviscous effects (general stress tensor). The calculations will complement the self-consistent calculations of Smith and Bishop as well as supplement them by including collisional effects. They should lead to a better understanding of the effects of mass flow (streaming along the field lines and rotation about the toroidal axis) on plasma losses due to classical diffusion. The model should indicate how well an ideal model approximates the behavior of a real plasma. At present Knorr's model for an ideal stellarator is being employed. It will be extended to represent spherators or multipoles. Author

N69-33521# Princeton Univ., N.J. Plasma Physics Lab.
VELOCITY-SPACE EFFECTS IN THE COMPUTER SIMULATION OF STELLARATOR CONFINEMENT
Craig G. Smith and A. S. Bishop (AEC, Washington, D.C.) *In* Los Alamos Sci. Lab. Proc. of the APS Topical Conf. on Numerical Simulation of Plasma 30 Sep. 1968 5 p refs (See N69-33499 19-25)
(Contract AT(30-1)-1238; Grant NSF GP-579)
Avail: CFSTI

A pronounced microinstability was observed in the course of a guiding-center simulation of axially symmetric toroidal confinement with the self-consistent electric field. The model and choice of values for the problem parameters follow those reported recently at Novosibirsk, with the sole exception that here the density is greater by a factor of ten. In this case, the electric field is larger, although the ratio of potential to kinetic energies remains at about 0.5%. The instability develops in a transient phase during which ions with large drift excursions are lost to the walls and the plasma seeks an equilibrium potential distribution. The evolution of the potential energy in the m = 2 azimuthal mode displays a high-frequency burst prior to decay to an equilibrium level. In the earlier stages, the electron distribution function is observed to have extremely well-defined gaps, independent of the magnetic moment, at parallel velocities 2.0 to 2.5 times thermal velocity. Author

N69-33548# Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland).
MEASUREMENT OF ELECTRON DENSITY GRADIENT IN A CONFINED ROTATING HIGH FREQUENCY PLASMA FIELD BY THE SCHLIEREN METHOD [MESURE DU GRADIENT DE DENSITE ELECTRONIQUE PAR LA METHODE SCHLIEREN DANS UN PLASMA CONFINE PAR CHAMP TOURNANT HF]
J.-M. Peiry Dec. 1968 40 p refs In FRENCH; ENGLISH summary
(LRP-38/68) Avail: CFSTI CSCL 21I

A schlieren system is described and streak pictures are presented which show the development with time of the electron density gradient in a RF rotating magnetic field pinch. Photographic densitometry of one of the streak photographs shows that it is possible to obtain quantitative measurements of the electron density gradient and, by means of numerical integration, the form of the density profiles. Absolute values of the density are evaluated. The precision and limitations of the method are analyzed and some improvements are proposed. Author

N69-33694# Wisconsin Univ., Madison. Dept. of Electrical Engineering.
PLASMA INSTABILITIES AND WAVES EXCITED BY AN ANISOTROPIC ENERGY DISTRIBUTION PRODUCED BY ELECTRON CYCLOTRON RESONANCE Quarterly Progress Report, 15 Dec. 1968 - 14 Mar. 1969
J. L. Shohet 15 Mar. 1969 34 p refs
(Contract AT(11-1)-1695
(COO-1695-15; QPR-8) Avail: CFSTI

The nature of the rf heating mechanism and the behavior of the radiation emitted from the plasma are considered. The electron cyclotron resonance device was operated both in a short rapidly repeating mode, and a long (up to 1 msec) mode to obtain measurements of free - free bremsstrahlung, wall bremsstrahlung, plasma diamagnetism, energetic electron flux and electron density in the discharge. An instability in the operation of the device was observed. This was characterized by rapid ejection of particles and rf emission. The onset of the instability was investigated as a function of the mirror ratio, magnet current, rf power and gas pressure. Theoretical work determined the nature of this instability to be of the electromagnetic type. Relativistic x-ray bremsstrahlung theory was expanded. Numerical evaluation of the Heitler differential scattering cross section was performed. A computer simulation of an electron cyclotron resonance plasma was made. It includes the self-consistent electric field of the electrons, the dc magnetic field and an external rf heating field. Author (NSA)

N69-33748*# Jet Propulsion Lab., Calif. Inst. of Tech. Pasadena.
A MARTIAN ENTRY PROPAGATION STUDY
John D. Norgard 15 Jun. 1969 28 p refs
(Contract NAS7-100)
(NASA-CR-103844; JPL-TR-32-1393) Avail: CFSTI CSCL 20I

Plasma effects on high-frequency electromagnetic wave propagation and the electromagnetic interaction with the shock induced plasma flow field generated around a blunt body capsule as it encounters the planetary atmosphere of Mars are examined. From two mathematical models of the Martian atmosphere and the entry trajectory characteristics of the capsule, it appears that the communication links to and from the capsule will be blacked out during entry because of the free electron concentration in the wake region of the capsule. Estimates of the free electron concentration in the wake region indicate peak values above the critical electron concentrations for S band transmission at 2.295 GHz and 400 Mhz. These frequencies are the transmission frequencies for communication links between the capsule and a relay bus and directly between the capsule and the earth, respectively. Author

N69-33763# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.

THE STABILITY OF SPHERICAL BLAST WAVES

Richard A. Gerwin and Richard B. Hall Jun. 1969 44 p refs
(DI-82-0858) Avail: CFSTI

The stability of strong spherical blast waves to infinitesimal perturbations is examined in the $(\gamma-1) < < 1$, where γ is the ratio of specific heats. By making a thin sheet approximation to the geometry it is possible to describe all perturbations as a sum of spherical harmonics. By transforming to a new time-like variable, a set of ordinary constant coefficient differential equations for the perturbation corresponding to each spherical harmonic can be obtained, along with a dispersion relation giving the growth rate of each harmonic. The growth rates are greatest for γ's closest to unity, and that the fastest growing harmonic has a wavelength several times the sheet thickness. It is concluded that spherical blast waves are theoretically unstable to infinitesimal perturbations, provided the condition $(\gamma-1) < < 1$ is satisfied. Author

N69-33906# Harry Diamond Labs., Washington, D.C.

CALCULATED STARK PROFILES FOR THE He LAMBDA 4471 Å LINE AND ITS FORBIDDEN COMPONENTS

Harry A. Gifska Dec. 1968 56 p refs
(AD-687283; TR-1406) Avail: CFSTI CSCL 20/9

Radiation emitted by a hot, partially ionized plasma is indicative of the conditions within the plasma. The energy levels of the constituent atoms are perturbed by the microelectric fields of the ions and electrons, so that the emitted spectral lines are broadened by the Stark effect. The stark profile of the 2(3)P-4(3)L, L=1,2,3 transition has been calculated for a range of electron densities between 10 to the 16th power and 10 to the 18th power electrons per cc and for temperature between 10,000 and 40,000 degrees K. The quasi-static approximation was used for ion effects and a generalized impact approximation was used to describe the electron effects. Tabulated profiles are presented that include the fine structure of the lower state. Error estimates show that the profiles are accurate to about 10 percent. Author (TAB)

N69-33923# Technische Hochschule Munchen (West Germany).

THE ROLE OF AZIMUTHAL COMPOUNDS IN THE ELECTRIC FIELD OF A Q MACHINE [DIE ROLLE AZIMUTALER KOMPONENTEN DES ELEKTRISCHEN FELDES IN EINER Q-MASCHINE]

Ernst Guilino (Ph.D. Thesis) 1969 55 p refs In GERMAN
Avail: CFSTI

Experimental proof is presented for the theoretical finding according to which divergences from the rotational symmetry in the temperature distribution on the end plates of a Q machine are responsible for the azimuthal components in the electric field of a plasma and for the resulting radial convective charge carrier losses in the axial magnetic field. Heating the end plates with rotating cathodes reduces the asymmetry of the temperature distribution to <0.1%. This in turn reduces the losses to a factor of 80. Transl. by K.W.

N69-33938# Boeing Scientific Research Labs., Seattle, Wash Plasma Physics Lab.

FAST BEAM-SWITCHING ELECTRON GUN FOR TRANSIENT BEAM-PLASMA INTERACTION STUDY

Glen J. Morris Jun. 1969 17 p refs
(DI-82-0871) Avail: CFSTI

An electron gun and deflection system used to study transient beam-plasma interactions is described. The gun produces a 1 or 2 mm diameter beam which can be switched off or on in 0.5 nsec. Two such guns used in a two beam device can easily excite large amplitude plasma oscillations. Measurements of damping in the time domain were made by measuring the damping rate of these oscillations following beam cutoff. Author

N69-34005# Aerospace Corp., El Segundo, Calif. Lab. Operations.

IMPURITY EFFECTS IN INTENSE PLASMA IRRADIATION SOURCES

Mitchell H. Dazey, H. L. L. van Paassen, and Vernal Josephson 15 Nov. 1968 19 p refs
(Contract F04701-68-C-0200)
(AD-687874; TR-0200(4308)-1; SAMSO-TR-69-132) Avail: CFSTI CSCL 20/9

The effect on the neutron yield of variations in electrode material in a paraboloidal deuterium plasma focus assembly was investigated. Beryllium, titanium, iron, copper, and palladium anode tips were tested. The most significant improvement in neutron yields was produced by elements that are good deuterium absorbers, such as titanium. Average neutron yields were increased by a factor of 20 when the copper anode tip was replaced by a titanium tip. Author (TAB)

N69-34079# Academy of Sciences (USSR), Moscow. Inst. Atomnoi Energii.

CONCERNING THE POSSIBILITY OF APPLICATION MICROWAVE FIELDS FOR THE STABILIZATION OF CONVECTIVE INSTABILITY OF PLASMA

V. M. Glagolev, I. N. Khromkov, and N. S. Cheverev [1968] 64 p refs Transl. into ENGLISH from Russian Rept. IAE-1490 In RUSSIAN and ENGLISH
(AEC-TR-7012; IAE-1490) Avail: CFSTI

The interaction of resonant-cavity uhf fields ($\omega \sim 2 \times 10^{10}$ sec^{-1}) with plasma ($n \sim 10^{13}$ to 10^{14} cm^{-3}) in a constant magnetic field was investigated. Paramagnetic currents arise in the plasma out to the surfaces as a result of the uhf field; the effect on increase of the static magnetic field inside the plasma agrees with estimates. For $\omega_H/\omega = 0.5$, electron parametric resonance was shown, leading to a sharp increase of plasma pressure. The possibilities of using the paramagnetic effect for stabilization of convective instabilities in different plasma systems are discussed. Author (NSA)

N69-34110# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).

RESEARCH AT THE INSTITUT FUER PLASMAPHYSIK

[1968] 14 p
Avail: CFSTI

Reviews the research projects at the Max-Planck-Institute of Plasmaphysics, Garching, describing nuclear fusion research, theta

pinch experiments, loss phenomenon investigations, plasma-wall interactions, hydrogen and helium stationary arc experiments, and theoretical investigations of associated problems aided by computer methods. ESRO

N69-34135# Advanced Kinetics, Inc., Costa Mesa, Calif.
PLASMA KINETIC ENERGY: RF CONVERSION Final Technical Report
R. W. Waniek, R. T. Givens, R. C. Mehra, and W. L. Bailey Griffiss AFB, N.Y. RADC Apr. 1969 180 p refs
(Contract F30602-68-C-0111)
(AD-687492; RADC-TR-68-606) Avail: CFSTI CSCL 9/5

The report covers an experimental and theoretical effort aimed at extending the microwave peak and average power emission levels obtained from a magnetized plasma in previous studies. Peak power levels exceed 10KW with measured values as high as 76KW have been recorded. Broadband microwave power generations over 5 octaves from 1 GHz to 30 GHz have been measured. Several configurations aimed at incorporating this generation scheme in noise generator devices are discussed. Author (TAB)

N69-34143# Avco-Everett Research Lab., Everett, Mass.
SINGLE COMPONENT PLASMAS Final Scientific Report
G. S. Janes Apr. 1969 34 p refs
(Contract AF 49(638)-1553)
(AD-687445; AFOSR-69-1254TR) Avail: CFSTI CSCL 20/9

Initial studies of low density crossed field D. C. plasma accelerators led to an investigation of single component electron rich plasmas. Electron densities of 4 x 10 to the 9th power/cc with accompanying negative potentials of 400 kv have been produced in toroidal geometries by injecting electrons into time dependent magnetic fields. Containment times of up to 1300 microsec were observed. Theoretical interpretations are provided. Possible applications to radiation shielding of astronauts, and to ion sources for nuclear physics accelerators and spectroscopy are described. This report is a guide to the fourteen papers listed in the included bibliography rather than a complete review of the program; however, some recent unpublished results and possible areas for future study are discussed. Author (TAB)

N69-34168# Atomic Energy Commission Research Establishment, Riso (Denmark). Physics Dept.
SHOCK FORMATION IN A Q-DEVICE PLASMA
Poul Michelsen Dec. 1968 37 p refs
(RISO-186) Avail: CFSTI

Experiments conducted with a Q-machine on the propagation of ion-acoustic shock waves and their reflection at various pressures to investigate the influence of plasma cooling on damping and propagation velocity of the waves are discussed. The corresponding fluid equations were integrated numerically and the results compared with experimental data. Author (ESRO)

N69-34326# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
COLLISIONLESS SHOCK STUDIES USING LASER-PRODUCED PLASMAS Progress Report, 4 Jun. 1968 - 31 Mar. 1969
David W. Koopman 31 Mar. 1969 26 p refs
(Contract AT(40-1)-3819)
(ORO-3819-1) Avail: CFSTI

The present investigation is directed toward generating the collisionless shock wave by the interaction of the streaming laser plasma with a lower-density stationary background plasma produced from diffusion or discharge plasma sources, with adequate diagnostic measurements aand sufficient control of conditions to allow a definitive comparison of the laboratory results to the theoretical predictions. The sections summerize the experimental facilities that have been developed and describe some of the preliminary results that have been obtained. Because the construction of the sources for the background plasma is not yet completed, no data is available on the collisionless shock phenomena. Author (NSA)

N69-34347# Maryland Univ., College Park. Dept. of Physics and Astronomy.
INVESTIGATION OF UNIVERSAL PLASMA INSTABILITIES Quarterly Report, 1 Sep. - 30 Nov. 1968
H. Lashinsky 30 Nov. 1968 13 p refs
(Contract AT(40-1)-3405)
(TID-25037; QR-11) Avail: CFSTI

The region of collisionless behavior in a Q-machine plasma was mapped. Plasma density profiles were taken at the two extremes. The observed profiles were asymmetric and a shift in the position of maximum density was noted. Plasma diagnostic work using an active Fabry-Perot microwave resonator is briefly discussed. NSA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N69-33223# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
EFFECT OF GROWTH PARAMETERS ON SUBSTRUCTURE SPACING IN NACL ICE CRYSTALS Research Report
G. Lofgren and W. F. Weeks Jan. 1969 24 p refs
(AD-687280; CRREL-RR-195) Avail: CFSTI CSCL 8/12

The effect of growth velocity v and solute concentration C on the cellular substructure that develops in NaCl ice is studied in the range 0.003 to 0.00001 cm/sec and 1 to 100 o/oo respectively. The substructure is the result of the formation of a constitutionally supercooled zone in the liquid ahead of the advancing interface. Unidirectional freezing runs were made by placing a cold plate in contact with the top of the solution and using cold-plate temperatures of -20 and -70C. The growth velocities were determined from a least-squares fit of the growth data to a power series. The average spacings between neighboring substructures and o were measured from photomicrographs of precisely located thin sections. Log-log plots of a sub o vs v show that the slope n gradually changes as a function of v. In the run where no convection occurs, n changes from 1/2 to 1 as v decreases in agreement with the prediction of Bolling and Tiller. The results of Rohatgi and Adams are also shown to be in good agreement with this prediction. On the other hand, when convection occurs, n changes from 1/2 to approximately 0 as v decreases. This is caused by convection reducing the effective value of C at the growing interface. The variation of a sub o with C is quite complex and shows a minimum in the composition range 9 to 25 o/oo NaCl. Author (TAB)

N69-33224# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DYNAMIC FRACTURE PRESSURE OF QUARTZ

J. D. Knapton and I. C. Stobie Jan. 1969 23 p refs
(AD-687286; BRL-TN-1712) Avail: CFSTI CSCL 20/12

The dynamic fracture pressure of quartz when mounted in a simple pressure transducer was measured based on pressure steps with rise times of 0.5 to 1 msec. Maximum measured dynamic fracture pressures were about 4 kbar (52 to 62 kpsi). Both natural and synthetic quartz samples were studied. The apparatus consists of a gas operated pressure vessel which utilizes the stretched stem principle for achieving fast valve opening times. Author (TAB)

N69-33262*# Radio Corp. of America, Princeton, N.J.
VAPOR PHASE GROWTH TECHNIQUE AND SYSTEM FOR SEVERAL III-V COMPOUND SEMICONDUCTORS Interim Scientific Report
J. J. Tietjen, R. Clough, A. B. Dreeben, R. Enstrom, and D. Richman Cambridge, Mass. NASA Electron. Res. Center Mar. 1969 29 p refs
(Contract NAS12-538)
(NASA-CR-86192; ISR-2) Avail: CFSTI CSCL 20B

For the first time single crystalline, colorless layers of GaN were grown with sufficient size to permit good electrical and optical characterization of this material. Good control of the composition of $In_{1-x}Ga_xP$ alloys was achieved, and it was determined that these alloys have direct band gaps as large as 2.12 eV. These alloys were doped both n- and p-type, and orange electroluminescence was generated by an $In_{1-x}Ga_xP$ p-n junction. $GaAs_{1-x}Sb_x$ alloys were prepared across the entire alloy series with good control of the composition. For the first time donor impurities added to GaSb during vapor-phase growth, and this permitted the preparation of vapor-grown p-n junction structures. A p-type alloy with 4% GaSb was prepared with a mobility of 400 cm^2/V-sec, which is equivalent to the highest yet reported for unalloyed p-type GaAs. $Ga_{1-x}Al_xAs$ alloys were prepared as single crystalline layers which is the first time that this material was prepared from the vapor phase. Polycrystalline InSb and InAs alloys, with $x > 0.95$ were prepared. Author

N69-33320*# Radio Corp. of America, Princeton, N.J. Research Labs.
VAPOR PHASE GROWTH TECHNIQUE AND SYSTEM FOR SEVERAL III-V COMPOUND SEMICONDUCTORS Interim Scientific Report
J. J. Tietjen, R. Clough, and D. Richman Mar. 1968 18 p refs
(Contract NAS12-538)
(NASA-CR-86191; ISR-1) Avail: CFSTI CSCL 20L

The vapor phase growth technique has been extended to the preparation of single crystalline InGaP alloys. In addition, improvements in the preparation of InGaAs alloys have been realized, and controlled n and p type doping of InAs has been achieved. The growth of single crystalline GaAs, GaP, GaSb, InAs, InP, and alloys of GaAsP, GaAsSb, InAsP, InGaAs, and InGaP, over wide composition ranges has also been achieved. Despite the great breadth of this work, the electrical properties of these materials have equalled or exceeded the state of the art. Furthermore, n and p type doping and multilayer structures have been prepared in a variety of these materials. Also, the effect of strain on lowering the carrier mobilities has been delineated. Only the preparation of InSb has not been realized. However, in general, the antimonide phase of this research has been severely restricted because of difficulties related to obtaining an adequate supply of stibine gas. Author

N69-33372*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
APPARATUS AND METHOD FOR SEPARATING A SEMICONDUCTOR WAFER
I. Litant, inventor (to NASA) and A. Scapicchio, inventor (to NASA) Filed 5 May 1969 13 p
(NASA-Case-ERC-10138; US-Patent-Appl-SN-821586) Avail: CFSTI CSCL 20L

The invention relates to the separation of semiconductor chips whose boundaries are defined by scribe lines in a substantially flat semiconductor wafer. The wafer will already have been processed to contain multiple microcircuits consisting of various diffusion and dielectric layers as well as the connecting metallized lines. The scribed wafer is positioned over a convex hemisphere. Thereafter, a flexible diaphragm engages the scribed wafer and, in tiny continuous increments, forces the wafer against the convex hemisphere so as to separate the wafer into individual chips with a minimum of flake and dust formation. The individual chips cannot slide about and damage adjacent chips. NASA

N69-33433*# National Aeronautics and Space Administration. Electronics Research Center.
SHIELDED-CATHODE MODE BULK EFFECT DEVICES
Frank R. Holmstrom, inventor (to NASA) Filed 16 May 1969 12 p
(NASA-Case-ERC-10119; US-Patent-Appl-SN-825258) Avail: CFSTI CSCL 20L

Gunn effect microwave diodes are described wherein that portion of the semiconductor material in which the dc field is below the critical value for negative differential conductivity is shielded from applied rf energy. High-conductance rf shielding is applied to the device in such a manner that applied rf fields interact only with the relatively short length portion of the semiconductor material in which the applied dc field is greater than the threshold for negative differential conductivity. Application of the rf shields thus suppresses transit-time oscillations normally occurring above the threshold voltage where negative differential conductivity exists. This enhances the maximum oscillation frequency of the device. The method also permits the fabrication of larger microwave diodes than previously possible, thereby reducing the problems of heat dissipation and fabrication. NASA

N69-33482*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
A METHOD FOR THE DEPOSITION OF BETA-SILICON CARBIDE BY ISOEPITAXY
Kazi E. Haq, inventor (to NASA) Filed 26 May 1969 7 p
(NASA-Case-ERC-10120; US-Patent-Appl-SN-827697) Avail: CFSTI CSCL 20L

A method for depositing epitaxial β-silicon carbide (β-SiC) films having a high degree of crystallographic perfection is disclosed. The method consists of the following steps: (1) conversion of a surface layer of a silicon wafer to β-SiC by placing the silicon wafer in a high vacuum with a low partial pressure of unsaturated hydrocarbon; and (2) deposition of the SiC by evaporation, sputtering, or chemical vapor method on the thin β-SiC layer formed by step (1). The method is suitable for use in the fabrication of high-temperature microelectronic components and electroluminescent display devices. NASA

N69-33614# Technisch Hochschule Munchen (West Germany).
THE EXTERNAL PHOTOELECTRIC EFFECT ON CESIUM ANTIMONIDE, ITS TIME DEPENDENCE, AND EFFECTS OF ADDITIONAL IR-RADIATION [DER AEUSSERE PHOTOEFFEKT AN CESIUM ANTIMONIDE SEINE ZEITABHAENGIGKEIT UND BEEINFLUSSING DURCH ZUSAETZLICHE IR-STRAHLUNG]
Gert B. Kabiersch (Ph.D. Thesis) 1968 80 p refs In GERMAN
Avail: CFSTI

The time dependence of photoluminescence of cesium antimonide layers is investigated by observing the effects of infrared radiation on the normal photon flux and by describing the sublinear behavior of the normal photon stream under the impinging light intensity. It is assumed that photoelectric excited electrons leave the cesium antimonide surface where donors with weak bonds are; these donors emit and absorb electrons and thus the equilibrium is affected by the impinging visible and infrared light as well as by the temperature. The extent of surface electron absorption is determined by the bending of the energy bands at the solid surface which in turn determine the photoemission flux of those reversible exchanges. Transl. by G.G.

N69-33817# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

THE QUANTITATIVE DETERMINATION OF PREFERRED ORIENTATION

N. A. Waterman Dec. 1968 17 p refs

(RD/B/N1239) Avail: CFSTI

A description is given of a method for determining the preferred orientation of crystallographic planes in a polycrystalline sheet specimen. It is shown that the details of the method vary with the material and the crystallographic plane under examination: the method is particularly useful when the sheet specimen shows no variation of preferred orientation with depth below the surface. While a complete description of the crystallite orientation distribution involves complicated correlation analysis a procedure is described for determining the percentage texture of a single set of planes along a given specimen direction to within ± 2%. Author

N69-33819# Institute of Technology, Helsinki (Finland).

THE GROWTH OF A STABLE SOLID NUCLEUS IN SUPERCOOLED PURE MELTS

J. Forsten and H. M. Miekk-Oja 1968 24 p refs 1968 24 p *Its* Acta Polytech. Scand., Chem. Met. Ser. 79

(PB-182952; APS-CH-79) Avail: CFSTI CSCL 11F

In the numerous theoretical investigations on the nucleation of a solid phase from a supercooled liquid most attention has been paid to the stage where stable nuclei develop from embryos, whereas the growth of the stable nuclei received little attention. This process is examined below, with an attempt to elucidate the growth of the nucleus after it surpasses the critical size. Neglecting the crystallographic anisotropy, the solidification is considered as an atomic process, considering additionally the thermal conditions during the growth of the nucleus. The discussion is further extended to the growth of dendrites in a supercooled pure melt. Author (USGRDR)

N69-33843# Iowa State Univ. of Science and Technology, Ames.

TRANSVERSE MAGNETORESISTANCE IN VANADIUM AND IN A CHROMIUM-RICH CHROMIUM VANADIUM ALLOY

Kerry Scott Nelson (M.S. Thesis) Feb. 1969 54 p refs

(Contract W-7405-eng-82)

(IS-T-295) Avail: CFSTI

Transverse magnetoresistance measurements were made on an oriented single crystal of high-purity vanadium in magnetic fields up to 48 kOe at liquid helium temperatures. The results are believed to represent the first experimental evidence of Fermi surface anisotropy in vanadium metal. The major features of the anistropic magnetoresistance behavior reveal that the Fermi surface of vanadium is qualitatively similar to that of niobium and tantalum. For a <110> oriented vanadium crystal, the measurements are consistent with open orbits occurring when the magnetic field is esr a <001>-type symmetry direction. The transverse magnetoresistance of an oriented chromium – vanadium alloy single crystal, containing 1.04 at. % vanadium, was studied at liquid helium temperatures in magnetic field intensities up to 48 kOe. Although the residual-resistance-ratio is very low (RRR = 13), information about Fermi surface topology is discernible in the angular dependence of the data. Author (NSA)

N69-33892# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.

DETERMINATION OF THE OXYGEN PARAMETER IN $ZnFe_2O_4$

M. Balanda, A. Szytula, Z. Dimitrijevic, and J. Todorovic Nov. 1968 20 p refs

(INP-667) Avail: AEC Depository Libraries

A sample of powdered $ZnFe_2O_4$ was investigated by means of neutron diffraction. From the diffraction patterns taken for angles between 11 and 87° at room and liquid nitrogen temperatures, it was concluded that zinc ferrite has a normal spinel structure (X = 0 ± 1%) with an oxygen parameter of 0.3853 ± 0.0005. Author (NSA)

N69-33893# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.

THE VALUATION OF THE TOTAL ABSOLUTE EFFICIENCIES FOR NaI(Tl) CYLINDRICAL AND WELL-TYPE CRYSTALS

Constantza Ionescu 1968 8 p refs

(IFA-MR-30) Avail: AEC Depository Libraries

The efficiency of the cylindrical and well-type crystals NaI(Tl) was estimated by means of some analytical formulas given. The source was considered placed somewhere on the crystal axis for the cylindrical crystals and in the bottom of the well for the well-type crystals. Two calibration curves were also calculated for a well-type 6×6 cm. Quartz and Silicon crystal and a cylindrical 4.5×5 cm. Tesla crystal. Good agreement with several efficiency data existing in literature was obtained. Author (NSA)

N69-33899# California Univ. Livermore. Lawrence Radiation Lab.

MOESSBAUER EFFECT IN SOLID KRYPTON

Keith G. Gilbert 4 Sep. 1968 64 p refs

(UCRL-50474) Avail: CFSTI

A theoretical and experimental investigation was conducted by the lattice dynamics of solid krypton (Kr), in both cases determining atomic mean square displacement (x^2) as a function of temperature. Rare gas crystals are the simplest solids. In the experimental work, (x^2) vs temperature is obtained by using the Moessbauer effect to measure the recoilless fraction in solid Kr over the temperature range of 5° to 85°K, and (x^2) vs temperature is calculated from the spatial distribution function, itself determined by a Monte Carlo calculation using the Lennard-Jones potential. This treatment is independent of the harmonic approximation. A second prediction for (x^2) follows from the current version of the phonon frequency distribution function. For all temperatures, the experimental values of mean square displacement (inferred from the recoilless fraction) are 1.5 to 2.5 times the theoretical predictions. This result is in apparent disagreement with measured thermodynamics of solid Kr. A proposed modification of the Kr frequency spectrum which might resolve this difficulty is discussed. Author (NSA)

N69-33901# Arizona State Univ., Tempe.

AN EXPERIMENTAL STUDY OF DEFECT ORDERING AND TRANSPORT PHENOMENA IN NONSTOICHIOMETRIC METAL OXIDES Annual Summary Report, 1 Apr. 1968-31 Mar. 1969

Clement J. Kevane Apr. 1969 17 p refs
(Contract N00014-68-A-0306)
(AD-687737) Avail: CFSTI CSCL 20/12

Experimental studies of transport phenomena and X-ray diffraction were carried out on reduced crystals of titanium oxide. Titanium oxide crystals were reduced by heating in vacuum with titanium metal to compositions between TiO(1.89) and TiO2. X-ray diffraction showed well-developed satellites to Bragg reflection spots at x = 1.98 (x in TiOx). Electrical resistivity was measured as a function of temperature at TiO(1.9700) and TiO(1.9830). At those compositions the electrical resistivity varied with positive temperature coefficient in a narrow range between 2.0 and 2.8 ohm cm in a temperature range from 200 to 800C. Thermal conductivity was measured between 4.2 and 100K and showed a maximum near 12K. Author (TAB)

N69-34015# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF ADSORBED OXYGEN ON ELECTRICAL AND PHOTOELECTRICAL PROPERTIES OF EPITAXIAL LEAD-SULFIDE FILMS
T. T. Bykova Feb. 1969 18 p refs Transl. into ENGLISH from Sipozium Po Elektronnym Protsessam Na Poverkhnosti i v Poluprovodnikov, Tr. (Novosibirsk), 1967 p 181–187
(AD-687246; FTD-MT-24-467-68) Avail: CFSTI CSCL 20/12

Inasmuch as earlier investigations of the effect of oxygen adsorbtion were made on polycrystalline lead-sulfide films, the authors have investigated the effect of adsorbed oxygen on the electric and photoelectric properties of single crystal films, compared these properties with those of polycrystalline layers, and determined the character of their variation upon adsorption of oxygen. TAB

N69-34103# Royal Radar Establishment, Malvern (England).
THE INFLUENCE OF IMPURITY BANDING ON THE EFFECTIVE DISTRIBUTION COEFFICIENTS DURING ZONE MELTING
J. Barthel et al [1968] 16 p refs Transl. into ENGLISH from Kristal and Tech. (West Ger.), v. 2, no. 2, 1967 p 205–215
(TIL/OT/8781; RRE-Trans-188) Avail: CFSTI

An electron zone melt apparatus is used for the experimental examination of the micro- and marco-distribution, as well as the macroscopic distribution coefficients. The zone length is calculated from autoradiographs of longitudal microsections averaged through the chilled zone and plotted against the crystal diameter. Author

N69-34146# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
AN EFFECT OF HIGH FIELDS ON THIN LAYERS OF InSb
Bengt Anderssen Griffiss AFB, N.Y. RADC Sep. 1968 16 p refs
(Contract AF 61(052)-895)
(AD-687490; RADC-TR-69-8; SR-25) Avail: CFSTI CSCL 20/12

Measurements on thin films of InSb are reported. High voltage pulses over the samples cause a surface pattern to show up. It has a periodicity perpendicular to the current direction of the same order as the thickness of the samples. Author (TAB)

N69-34217# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
PROGRESSIVE AND RESONANT WAVE HELICES. APPLICATION TO ELECTRON PARAMAGNETIC RESONANCE [HELICES A ONDES PROGRESSIVES ET RESONNANTES. APPLICATION A LA RESONANCE PARAMAGNETIQUE ELECTRONIQUE]
Ferdinand Volino (Ph.D. Thesis) Apr. 1968 102 p refs In FRENCH; ENGLISH summary
(CEA-R-3706) Avail: CFSTI

It is shown that helices can be used as resonant systems and the properties are theoretically and experimentally studied. Resonant helices for electron paramagnetic resonance in X-band are described and their sensitivity and the sensitivity of a normal resonant cavity are compared. For cylindrical samples of less than 3 mm diameter, the helix is more sensitive and can produce more intense microwave magnetic fields. Author (ESRO)

N69-34378*# Northrop Corp., Hawthorne, Calif.
EFFECTS OF IMPURITIES ON CARRIER LIFETIME IN BULK SOLAR CELL MATERIAL Final Report
R. F. Bass and O. L. Curtis, Jr. JPL May 1969 42 p refs Prepared for JPL
(Contract NAS7-100; JPL-952256)
(NASA-CR-104067; NCL-69-29R) Avail: CFSTI CSCL 20L

Lifetime degradation due to low energy electron and gamma irradiation was investigated in bulk silicon containing certain unconventional dopants or excess oxygen concentrations. Dopant impurities investigated were aluminum, beryllium, chlorine, lithium, and sodium. All of the impurities, with the exception of lithium, were introduced during the crystal growth process. Lithium-doped material was prepared by diffusing lithium into previously grown n-type crystals. Due to the poor electrical properties of crystals containing beryllium and chlorine, the radiation sensitivity of material containing these dopants could not be evaluated. The radiation tolerance of material containing the remaining impurities was in no case clearly superior to that of material containing conventional boron or phosphorus dopants. However, aluminum-doped silicon appeared promising in some cases, and in material containing low oxygen concentrations did provide advantages over comparable boron-doped material upon thermal annealing. The annealing behavior of gamma irradiated material was dose dependent. Author

N69-34417# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Inst. fuer Kernphysik.
SCATTERING OF THERMAL NEUTRONS ON SINGLE CRYSTALS OF ICE [STREUUNG THERMISCHER NEUTRONEN AN EIS-EINKRISTALLEN]
J. Daubert, H. Jex, and D. Rossberg Nov. 1968 48 p refs In GERMAN
(IKF-22) Avail: AEC Depository Libraries

The total neutron cross sections $\sigma_{tot}(E_0)$ of water, polycrystalline ice and single crystals of ice in the energy range from 2 MeV to 1 eV were determined by neutron transmission measurements. Especially the dependence of the cross sections on the orientation of the single crystals was investigated and is qualitatively interpreted. Author (NSA)

N69-34424# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleares.
SEMICONDUCTOR DETECTORS OF NUCLEAR PARTICLES [DETECTEURS DE PARTICULES NUCLEAIRES A SEMICONDUCTEUR]
Jean Messier Jun. 1968 24 p refs In FRENCH Presented at Intern. Conf. on Electron. and Automation, Herceg Novi, Yugoslavia, 24 Jun. 1968
(CEA-CONF-1233; CONF-680642-6) Avail: AEC Depository Libraries

The physical principles on which are based the operation of semiconductor detectors are reviewed. Also the most important problems in the construction and use of these detectors are discussed. NSA

N69-34498# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LOW-TEMPEATURE CUBIC AND TETRAGONAL FORMS OF ZIRCONIUM DIOXIDE

Yu. M. Polezhaev Jan. 1969 7 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 41, no. 11, 1967 p 2958–2959
(AD-687236; FTD-AT-23-1066-68) Avail: CFSTI CSCL 20/2

The existence of low-temperature cubic and tetragonal forms of zirconium dioxide was found to be a consequence of the reduction of the surface energy of ZrO2 crystals in the series monoclinic to tetragonal to cubic. Author (TAB)

N69-34566# Chicago Univ., Ill. James Franck Inst.

PHASE TRANSITIONS OF THE ELECTRON FLUID

Nathan Wiser (IBM, Yorktown Heights, N.Y.) and Morrel H. Cohen 1969 21 p refs
(Contract Nonr-2121(22))
(AD-688477) Avail: CFSTI CSCL 20/12

It is shown that current many-body theory predicts that the high-density phase of the electron fluid is mechanically unstable for r sub s > 5 and thermodynamically unstable for r sub s > 4. The pressure-density phase diagram of the electron fluid is shown to consist of a high-density, liquid-like region and a low-density, gas-like region, separated by a two-phase region. The low-density segment of the coexistence curve in the limit of low temperature and pressure is calculated. Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-33247# Frankford Arsenal, Philadelphia, Pa. Quality Assurance Directorate.

DETERMINATION OF POTASSIUM, SODIUM, CALCIUM, AND BARIUM IN NITROCELLULOSE-BASE PROPELLANTS BY ATOMIC ABSORPTION

Julius B. Apatoff and George Norwitz Feb. 1969 26 p refs
(AD-687273; FA-T69-1-1) Avail: CFSTI CSCL 19/1

Atomic absorption methods are proposed for the determination of potassium, sodium, calcium, and barium in nitrocellulose-base propellants. A 1-gram sample is treated with a mixture of 10 ml of nitric acid and 3 ml of perchloric acid and the solution is evaporated to a volume of approximately 1 ml. The solution is then diluted to an appropriate volume (usually 500 ml for potassium or 100 ml for sodium, calcium, and barium) and the absorption is determined with an atomic absorption spectrophotometer. There are no significant interferences from the amounts and ratios of salts found in nitrocellulose-base propellants. The accuracy of the methods was checked with actual and synthetic propellants. The proposed methods are more reliable and considerably more rapid than the wet chemical methods presently used for the determination of inorganic salts in nitrocellulose-base propellants. Author (TAB)

N69-33271*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PROPULSION DIVISION

In its Supporting Res. and Advanced Develop. 30 Apr. 1969 p 176–212 refs (See N69-33263 19-31)
Copyright. Avail: CFSTI CSCL 21I

The failure mechanism of solid propellant grains during thermal cycling was attributed to the generation of voids within the interior body of the grains which in turn were generated by internally evolving gas after sterilization. Results of differential scanning calorimetry on ammonium perchlorate samples showed the decomposition differences between various oxidizer lots. Modification of thrust initiation transients to very low rates was achieved by the addition of gases to the motor chamber so that the main motor chamber pressure increased to the desired slow rate due to the combination of igniter gas flow and combustion products. One dimensional unsteady compressible flow equations were evaluated for their applications to rocket motor and nozzle problems. Polymer research activities centered on the effects of silver oxide on polyethylene battery separators. Proposed designs for thermionic reactor systems and space power plants were depicted, the performance of a uranium dioxide thermionic reactor was tested, and a liquid lithium magnetohydrodynamic power conversion cycle was evaluated. Resonant combustion research for liquid combustion systems showed that large amplitude, discrete pressure disturbance propagation during combustion caused spontaneous resonance or popping. G.G.

N69-33347*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

NEW STERILIZABLE PROPELLANT OXIDIZER IN BIPROPELLANT COMPOSITION

Joseph R. Wrobel, inventor (to NASA) Filed 6 May 1969 8 p
(Contract NAS7-100)
(NASA-Case-NPO-10687; US-Patent-Appl-SN-822310) Avail: CFSTI CSCL 21I

Maximum density fuming nitric acid (MDFNA) is a readily sterilizable liquid propellant oxidizer. Although previously known, MDFNA has not been used as a liquid propellant material. It is made by dissolving nitrogen dioxide into nitric acid until the nitric acid reaches a maximum density, which is at a composition of about 43.9% nitrogen dioxide and 56.03% nitric acid. The addition of .01 to 1.0 weight percent of hydrogen fluoride as a corrosion inhibitor is proposed. Used with a fuel such as monomethylhydrazine or anhydrous hydrazine, successful performance data were obtained with the MDFNA. NASA

N69-33383# Explosives Research and Development Establishment, Waltham Abbey (England).

A NEW EXPLOSIVES TECHNIQUE FOR SYNTHESIZING A WIDE RANGE OF PRESSURE WAVEFORMS IN AIR. PART 1: APPROXIMATE THEORY OF AIR BLAST FROM EXTENDED EXPLOSIVE CHARGES

S. J. Hawkins and J. A. Hicks 2 Oct. 1968 29 p refs
(AD-687222; ERDE-9/R/68; WAC/189/08) Avail: CFSTI CSCL 19/1

A new technique for generating air blast waves using spatially extended explosive charges has been devised. It has been found to be capable of synthesizing pressure waveforms having a wide range of shapes and durations and was applied, among other things, to the simulation of sonic bangs, the applications of the technique being described separately in the second part of the report (ERDE 10/R/68). In this first part of the report a phenomenological theory of the air blast from such charges is developed under certain simplifying assumptions. These assumptions are firstly that the given spatial distribution of explosive may be reduced to an equivalent linear distribution in the line-of-sight by making an extension of the energy hypothesis commonly applied to the case of spherically symmetric explosions. Secondly, this linear distribution

is in turn regarded as an infinite set of elementary linear charge elements generating acoustic wavelets the combined effects of which are obtained by linear superposition. For such a model of the air blast process, the pressure wave in the far field may be represented exactly in terms of an assumed shape of element wavaform. Author (TAB)

N69-33584# Technische Hochschule Munchen (West Germany).
ON THE ANALYTICAL PERFORMANCE PREDICTION FOR HIGH-ENERGY SPACECRAFT PROPELLANTS IN THE PRESENCE OF HETEROGENEOUS COMBUSTION PRODUCTS [ZUR ANALYTISCHEN LEISTUNGSBESTIMMUNG VON HOCHENERGETISCHEN RAUMFHRTTREIBSTOFFEN BEI ANWESENHEIT VON HETEROGENEN VERBRENNUNGSPRODUKTEN]
Hans Heinz Seidel 1968 372 p refs In GERMAN
Avail: CFSTI

Kinetic and thermal losses in the condensing phase of high energy rocket propellants are attributed to the formation of liquid and solid combustion products. Equations describing the gas-particle system inside a rocket nozzle are developed and used to predict propellant performance at subsonic, transonic, and supersonic speeds. Performance estimates are obtained for the high energy propellant combination hydrogen-beryllium-oxygen at various mixture ratios and nozzle sizes by computer programs. Transl. by G.G.

N69-33803# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STUDIES ON THE EFFECT OF FUEL INJECTION ON THE IGNITION PROCESS OF THE HYDRAZINE-NITRIC ACID SYSTEM [UNTERSUCHUNGEN ZUM EINFLUSS DER TREIBSTOFFEINSPRITZUNG AUF DEN ZUNDVERGANG AM SYSTEM HYDRAZIN-SALTPETERSAURE]
Harald Twardy 28 Jun. 1969 27 p refs Transl. into ENGLISH of DFL report DLR-FB-68-85
(Contract NAS7-100)
(NASA-CR-103880; DLR-FB-68-85) Avail: CFSTI CSCL 21I

Ignition tests in the impinging stream process were performed for the purpose of investigating the effects of various injection conditions under ignition. Changes were made in the injection nozzle diameter, impingement angle of the two streams, injection pressure, and mixture ratio. Studies also included a separate injection head and an injection system provided with a combustion shroud. Special attention was given to hydrazine -nitric acid propellant. Comparisons of the results were made and the tests were carried out under ambient conditions. Author

N69-33878# Rocket Propulsion Establishment, Westcott (England).
STRUCTURAL MATERIALS FOR USE AT CRYOGENIC TEMPERATURES
P. Midgley Mar. 1969 14 p refs Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 8-11 Apr. 1969
Copyright. Avail: CFSTI; HMSO

A general review of the behavior of materials at cryogenic temperatures is presented, including the effect of temperatures ranging over 20°K to 293°K on the mechanical properties of aluminium alloys, stainless steels and composite materials for use in space, particularly cryogenic propellent tank structures. ESRO

N69-34102# Pratt and Whitney Aircraft, East Hartford, Conn.
EMULSIFIED FUELS COMBUSTION STUDY Final Report, 29 Jun. 1967-28 Sep. 1968
Theodore R. Kobish, Roger A. Roberts, Henry R. Schwartz, Robert E. Gordon, and Earle A. Ault Ft. Eustis, Va. Army Aviation Mater. Labs. Feb. 1969 141 p ref
(Contract DAAJ02-67-C-0094)
(AD-687325; PWA-3515; USAAVLABS-TR-69-4) Avail: CFSTI CSCL 21/4

The report describes a research program conducted to determine the cold flow, combustion, and corrosion characteristics of three different Government selected and supplied emulsified JP-4 fuels and to compare them to liquid JP-4 fuel. The program consisted of a study of the emulsified fuel flow and spray characteristics, an evaluation of the combustion and altitude relight capabilities of emulsified fuels relative to JP-4 fuel using a can-type burner rig that simulates a gas turbine environment, and an evaluation of the corrosion characteristics of the emulsified fuels relative to liquid JP-4 on several coated and uncoated turbine materials when operating at 1700F and 2000F average combustor exit temperatures for 75 hours each. The cold flow test results show that, except for individual deviations due to formulation differences, the flow behavior of two out of the three emulsified fuels through a typical gas turbine fuel system is nearly identical to the flow of liquid JP-4 fuel. The spray characteristics of these emulsified fuels flowing through a pressure atomizing fuel nozzle were found to be essentially identical to liquid JP-4. The results indicated that only minor differences in combustor performance exist between JP-4 and emulsified fuel under the steady-state conditions tested. The same was found to be true for light-off transient and altitude relight conditions. The steady-state corrosion tests have shown that some slight vane surface distress and corrosion were caused by two of the emulsified fuels, whereas the third emulsified fuel caused severe distress. Although the combustion characteristics of the emulsified fuels are nearly identical to JP-4, it is recognized that additional work on the fuel system to prevent nozzle screen plugging must be done before the emulsified work can be effectively utilized in a conventional gas turbine. Of the three emulsified formulations tested, it is concluded that emulsified fuel-A shows superior overall performance relative to the other emulsified fuels. Author (TAB)

N69-34569# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETONATION OF ELONGATED CHARGES WITH CAVITIES
A. S. Zagumennov et al [1969] 7 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 2, 1969 p 79-83
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Channel phenomena in elongated charges of cast high explosive with cavities of various shapes are investigated. The presence of a transition mode is established, and the channel shock velocities in the transition mode are measured. Estimates are made of the cumulative jet parameters generated in tubular charges. The schemes for the experimental investigation of the detonation of tubular charges with an air cavity are described. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-33211*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GASEOUS-HYDROGEN PRESSURANT REQUIREMENTS FOR THE DISCHARGE OF LIQUID HYDROGEN FROM A 3.96 METER (13 FT) DIAMETER SPHERICAL TANK
Robert J. Stochl, Phillip A. Masters, Richard L. De Witt, and Joseph E. Malloy Washington Aug. 1969 62 p refs
(NASA-TN-D-5387) Avail: CFSTI CSCL 21E

The effects of vrrious physical parameters on the pressurant gas requirements during the pressurization and expulsion of liquid hydrogen from a 3.96 meter diameter spherical tank. The experimental results were also compared with results predicted by a previously developed analytical program. The experimental results show that injector geometry, inlet gas temperature, and tank pressure level have a strong influence on the actual pressurant gas requirements. There was fair agreement between the analysis and experimental data when using the hemisphere injector. However, the analysis in its present form does not adequately predict pressurant requirements when using the straight pipe injector. Author

N69-33294*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PLUME FLOW FIELD ANALYSIS FOR LIQUID PROPELLANT ROCKET ENGINES
Joseph L. Sims and Terry Greenwood *In its* Res. Achievements Rev., Vol. 3 1968 p 35-50 refs (See N69-33289 19-31)
Avail: CFSTI CSCL 21H

Several computer programs were developed to solve various technical aspects of the overall plume analysis problem. Conclusions were also drawn from the few detailed experimental data for liquid fuel rocket engines by comparing them with theoretical calculations: (1) Mixing and non-adiabatic combustion adjacent to the injector face cannot be adequately treated by purely theoretical analyses. (2) For nozzles operating with variable O/F ratio in the radial direction, the flow from the injector face to the throat entrance should be computed with programs that contain the diffusion-mixing terms. (3) A transonic solution which can handle equilibrium thermochemical properties and variable O/F ratios is required. (4) The point switch from equilibrium to frozen thermochemical models apparently yields excellent results in the inviscid flow field calculations. (5) For afterburning in the free shock layer, chemical reaction times and flow times are comparable. (6) Condensation phenomena and transition to free molecular flow are being considered in an elementary manner and much work remains to be done in these areas. Author

N69-33305*# Aerojet-General Corp., Sacramento, Calif.
DEVELOPMENT OF A THERMAL BARRIER COATING FOR USE ON A WATER-COOLED NOZZLE OF A SOLID PROPELLANT ROCKET MOTOR Final Report
V. R. Stubbs 3 May 1969 79 p refs
(Contract NAS3-10302)
(NASA-CR-72549) Avail: CFSTI CSCL 21H

An analytical study and laboratory evaluation of plasma-arc-sprayed coatings was conducted. At the conclusion of this effort, three coating systems were recommended for testing with subscale nozzles. For subscale testing, three Titan II second-stage combustion chambers were modified and installed on surface Wing I Minuteman solid propellant motors. The first test firing was with an uncoated nozzle and resulted in a typical heat transfer type burnout. The second and third tests were with coated nozzles and were successful. On the third firing, the water flow rate was reduced by 58% after start-up. Author

N69-33308*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THRUSTER MAINTENANCE SYSTEM
Jerry Hethcoat, inventor (to NASA) and Roland H. Norton, inventor (to NASA) (Brown Engineering Co.) Filed 9 Jul. 1969 11 p
(Contract NAS8-20073)
(NASA-Case-MFS-20325; US-Patent-Appl-SN-840176) Avail: CFSTI CSCL 21H

A portable air lock for removing and replacing a thruster system on a spacecraft is described. The thruster is mounted on the exterior surface of a panel removably mounted on the spacecraft wall. The air lock may be sealed to the interior surface of the spacecraft wall at the removable panel. An operator within the spacecraft inserts his arms into space suit type gloves extending into the air lock which enable him to remove the thruster panel and replace it with a new panel. The portable air lock may then again be removed from the spacecraft wall. NASA

N69-33319*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMPLIFIED ANALYTICAL MODEL FOR USE IN DESIGN OF PUMP-INLET ACCUMULATORS FOR THE PREVENTION OF LIQUID-ROCKET LONGITUDINAL OSCILLATION (POGO)
William Lewis Washington Aug. 1969 38 p refs
(NASA-TN-D-5394) Avail: CFSTI CSCL 21H

Prevention of pogo by means of an accumulator at the pump inlet is facilitated by a simplified analytical model that expresses the net in-phase force feedback in terms of the admittance of the accumulator, thereby providing a frame of reference for the use of judgment in the design. Treating the effects of the fuel and oxidizer systems as independent and additive and reckoning force feedback at the structure modal frequency only permit a simple description of the primary mechanism. A novel feature of the model is that the effect of outflow perturbations on tank-bottom pressure is included in the net-thrust function. Author

N69-33364*# Israel Program for Scientific Translations, Ltd., Jerusalem.
MECHANICS OF SPACEFLIGHT LOW-THRUST
G. L. Grodzovskii, Yu. N. Ivanov, and V. V. Tokarev 1969 578 p refs Transl. into ENGLISH of the book "Mekhanika Kosmicheskogo Poleta S Maloi Tyagoi" Moscow, Izd. *An SSSR, 1966 578 p Published for NASA and NSF*
(NASA-TT-F-502; TT-68-50301) Avail: CFSTI CSCL 21H

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15. FINITE-DIMENSIONAL NUMERICAL OF ESTABLISHING OPTIMUM SOLUTIONS p 463–475 (See N69-33369 19-19)

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N69-33355*# Israel Program for Scientific Translations, Ltd., Jerusalem.

BASIC PARAMETERS AND LAYOUT OF SPACE PROPULSION SYSTEMS

In its Mech. of Spaceflight Low-Thrust 1969 p 1–13 (See N69-33354 19-38)

Avail: CFSTI CSCL 21H

The basic physical principles and generalized parameters of space propulsion systems are described as far as necessary for a discussion of the mechanics of space flight. It is emphasized that the weight problem (for instance, the problem of finding the conditions for delivery of a maximum payload) is of outstanding importance in spaceflight mechanics, because of its determining influence on the spacecraft parameters. The complete system of equations is given and analyzed describing the behavior of the spacecraft. This system consists of the vectorial equation of motion and the relationships between the weight characteristics and the propulsion system parameters. The general layout of a space propulsion system is presented both in narrative and flow diagram form. Conditions of space flight are considered including the following: (1) gravitational fields; (2) environmental parameters; and (3) meteors. K.R.G.

N69-33356*# Israel Program for Scientific Translations, Ltd., Jerusalem.

PHYSICAL PRINCIPLES OF THE ELEMENTS OF SPACE PROPULSION SYSTEMS

In its Mech. of Spaceflight Low-Thrust 1969 p 14–81 (See N69-33354 19-28)

Avail: CFSTI CSCL 21H

Physical aspects of various elements of space propulsion systems are detailed. Specific attention is directed to the following: (1) rocket engines including rocket thrust and drag, nozzles, high temperature thermal rocket engines, electrodynamic and electrostatic engines, solar sail, and isotope sail; (2) powerplants of spacecraft including energy sources, systems of energy conversion, energy accumulators, working fluid supply and storage systems, powerplants using up working fluid from the environment, and drag acting on the spacecraft during flight in the atmosphere; and (3) cooling systems for spacecraft powerplants including radiation cooling systems, system of energy removal from a flat-tube radiator with fins, energy removal from a star-shaped tube radiator with fins, energy removal from a belt radiator, and weight characteristics of spacecraft powerplants. K.R.G.

N69-33357*# Israel Program for Scientific Translations, Ltd., Jerusalem.

GENERALIZED PARAMETERS OF SPACE PROPULSION SYSTEMS

In its Mech. of Spaceflight Low-Thrust 1969 p 82–88 (See N69-33354 19-28)

Avail: CFSTI CSCL 21H

The generalized characteristics of the main types of space propulsion systems discussed in the literature are considered from the viewpoint of space flight mechanics. The introduction of generalized parameters schematizes the problem while preserving its principal traits. A more detailed study may be based on the principles described. The propulsion systems are grouped into three classes, depending on the basic limitations imposed by the physical principles. A limitation is considered basic if the flight conditions are optimum when the limit considered is reached; such limitations may be imposed on the exhaust velocity of the gases in the jet, the power, or the thrust. The propulsion systems considered are: (1) propulsion systems with limited exhaust velocity; (2) power-limited propulsion systems; and (3) thrust limited propulsion systems (sail systems). K.R.G.

N69-33358*# Israel Program for Scientific Translations, Ltd., Jerusalem.

IDEAL POWER-LIMITED ENGINE. SEPARATION OF THE VARIATIONAL PROBLEM. OPTIMUM WEIGHT RATIOS

In its Mech. of Spaceflight Low-Thrust 1969 p 89–117 (See N69-33354 19-28)

Avail: CFSTI CSCL 21H

The problem of delivering a maximum payload with an ideal propulsion system of limited power is considered. The control characteristic and the weight formula for an ideal engine of limited power are presented. These equations describe the following properties of the ideal engine: (1) there are no losses of working fluid or power, (2) the control is subjected only to a power limitation (the requirement that the mass flow rate be nonnegative is not taken into account), and (3) the weight of the engine depends linearly on the maximum power. Problems detailed include: (1) optimum weight ratios when engine weight is constant or varies stepwise; (2) optimum program of engine-weight variation; and (3) utilization of jettisoned engine parts as working fluid. K.R.G.

N69-33359*# Israel Program for Scientific Translations, Ltd., Jerusalem.

IDEAL POWER-LIMITED ENGINE. OPTIMUM PROGRAMS OF THRUST ACCELERATION

In its Mech. of Spaceflight Low-Thrust 1969 p 118–166 (See N69-33354 19-28)

Avail: CFSTI CSCL 21H

The dynamic problem of the optimum law of thrust acceleration is altered in its formulation so as to eliminate the differential constraints. The problem then reduces to the determination of extremals, paths in position-velocity space (between given points) along which the functional is a minimum for some given time interval. Alternately, the problem can be formulated as Mayer's problem. Areas covered in detail include the following: (1) equations of the extremals and their properties; (2) optimum interplanetary trajectory with ideal power-limited engine; (3) optimum maneuvers of guided satellites with ideal power-limited engine; and (4) parameters of a vehicle with ideal power-limited engine. K.R.G.

N69-33360*# Israel Program for Scientific Translations, Ltd., Jerusalem.

UNTHROTTLED ENGINES. SEPARATION OF THE VARIATIONAL PROBLEM. OPTIMUM PROGRAMS OF THE THRUST VECTOR

In its Mech. of Spaceflight Low-Thrust 1969 p 187-201 (See N69-33354 19-28)
Avail: CFSTI CSCL 21H

Since ideal engines must be ideally throttled, i.e., the only limitations imposed on their control must be those inherent in the type of engine studied (such as the limitations imposed on the power or the exhaust velocity) and since the solution of the optimization problem with this formulation usually leads to impracticable control functions for some of the engine parameters, the other extreme of the control possibilities, that of the unthrottled engine, is treated. An engine is deemed unthrottled if it can either be fired so that the thrust and the propellant flow rate are constant or cut off so that the thrust and the propellant flow rate vanish. No restrictions are imposed on the change of thrust direction. As with ideal engines, the variational problem is separated into weight and dynamic parts. Areas examined in detail include: (1) separating the variational problem into weight and dynamic parts; (2) equations for the optimum thrust vector program; (3) optimum interplanetary flight with unthrottled engines; (4) optimum maneuvers of guided satellites with unthrottled engines; and (5) parameters of a vehicle with power-limited unthrottled engine. K.R.G.

N69-33361*# Israel Program for Scientific Translations, Ltd., Jerusalem.
REAL POWER-LIMITED ENGINES
In its Mech. of Spaceflight Low-Thrust 1969 p 202-238 (See N69-33354 19-28)
Avail: CFSTI CSCL 21H

Real power limited propulsion systems differ mainly in the following points from ideal propulsion systems: (1) In real engines some working fluid and power are lost due to phase transitions (ionization and neutralization), inhomogeneity of the jet in the nozzle, etc. These losses are characterized by the coefficients describing the utilization of the working fluid and power respectively. (2) The engine can be controlled by varying the power and flow rate of propellant supplied to it, while the geometrical parameters and those of the electrical circuit remain constant. (3) In an ideal engine the weights of the power source and converter, and nozzle are functions of the maximum power only; the weight of the real power source and converter are determined by the value of the maximum power while the nozzle weight depends on the type of nozzle being used and the limiting values of the independent controls. (4) While the operating time of an ideal power-limited engine is unlimited, that of a real engine has an upper bound determined by the working-fluid reserve of the engine. These properties of real engines are general, so that the actual expressions for the weight and the thrust depend on the type of nozzle used. K.R.G.

N69-33362*# Israel Program for Scientific Translations, Ltd., Jerusalem.
ENGINES WITH LIMITED EXHAUST VELOCITY. OPTIMUM COMBINATION OF ENGINES WITH LIMITED EXHAUST VELOCITY AND LIMITED POWER
In its Mech. of Spaceflight Low-Thrust 1969 p 239-264 (See N69-33354 19-28)
Avail: CFSTI CSCL 21H

All thermal rocket engines belong to the category with limited exhaust velocity. This velocity is limited due to the maximum temperature which the cumbustion chamber walls or the heat exchanger can withstand. Engines in this category are characterized by a relatively low weight per unit thrust. They are capable of delivering high thrusts and are, therefore, called high-thrust engines. In view of the low unit weight, the engine weight is usually neglected in optimization problems involving engines with limited exhaust velocities. Such an approximation is, however, inaccurate when a high thrust acceleration is required. Defined are the space of the maneuver parameters, the parameters of the engine with limited exhaust velocity, and the parameters of the power-limited engine for each maneuver. Further discussion is devoted to the characteristics and optimum work regimes of engines with limited exhaust velocities; the optimum conditions of combining engines with limited exhaust velocity and limited power are established; and a criterion for finding the regions of application of power-limited engines is given. The boundaries of these regions are determined for a number of maneuvers. K.R.G.

N69-33363*# Israel Program for Scientific Translations, Ltd., Jerusalem.
PROPULSION SYSTEMS WITH ENERGY AND MASS ACCUMULATION. ENGINES WHOSE THRUST AND POWER ARE FUNCTIONS OF THE COORDINATES AND TIME
In its Mech. of Spaceflight Low-Thrust 1969 p 265-336 (See N69-33354 19-28)
Avail: CFSTI CSCL 21H

Optimization problems of the parameters and control functions for the following types of propulsion systems are treated: (1) power-limited engines with accumulation of thermal or electric energy; (2) engines with limited power or limited exhaust velocity which accumulate atmospheric gas to be used as working fluid; (3) solar sail (the maximum thrust depends on the distance from the Sun and the sail orientation); (4) isotopic sail (the maximum thrust depends on the time); (5) engines with solar power sources (the maximum power depends on the distance from the Sun); and (6) engines with isotopic power source (the maximum power depends on the time). K.R.G.

N69-33364*# Israel Program for Scientific Translations, Ltd., Jerusalem.
MODIFICATIONS OF THE OPTIMUM CRITERION
In its Mech. of Spaceflight Low-Thrust 1969 p 337-364 (See N69-33354 19-28)
Avail: CFSTI CSCL 21H

The previously presented formulation of the optimization problems is changed in two senses. First, the weight criterion is replaced by the cost criterion and second, the propulsion system parameters are selected not for a single maneuver but for a range of maneuvers. The distribution of the required number and types of maneuvers is either fixed, or considered as unknown; in the latter case use is made of the theory of games. For each specific maneuver, the optimum working-fluid reserve is determined for selected universal parameters of the propulsion system. Detailed examinations are presented for the following: (1) minimizing the cost of a maneuver; (2) universal propulsion system for a given class of maneuvers; (3) the game approach to the problem of selecting the optimum parameters of the propulsion system; and (4) optimum working-fluid reserve for a given maneuver with fixed engine parameters. K.R.G.

N69-33365*# Israel Program for Scientific Translations, Ltd., Jerusalem.
RELIABILITY CONSIDERATIONS IN OPTIMIZATION PROBLEMS
In its Mech. of Spaceflight Low-Thrust 1969 p 365-402 (See N69-33354 19-28)
Avail: CFSTI CSCL 21H

External and internal random factors causing failure are distinguished; meteoric punctures belong to the first category, while processes such as wear exemplify the second. The probability of failure could depend on the time, the coordinates, the parameters of the engine and vehicle, or the engine operating regime. Allowance for a reliability factor will therefore lead to an adjustment in the usual programs for the optimum controls and parameters. Reliability is defined as the probability of uninterrupted engine operation during a specified maneuver. The maneuver is considered as unfulfilled if

(and only if) the engine fails. The probability of executing a maneuver is either specified or is selected so as to be an optimum in some sense. Single section and multisectional engines are considered; the variational problems are solved for models of the basic maneuvers. The case of a fixed engine operating time can be considered a particular case of the problem of fixed reliability (assuming the probability of engine failure to be a function of the operating time only). K.R.G.

N69-33374*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALOG STUDY OF FACTORS AFFECTING INJECTION STARTS OF A CLOSED-LOOP SINGLE-SHAFT BRAYTON POWER PLANT

Hugh Klassen Jul. 1969 22 p refs

(NASA-TM-X-52638) Avail: CFSTI CSCL 21E

The starting performance of a Brayton cycle test loop was simulated with an analog computer. The test loop turbomachinery consisted of a turbine, compressor and alternator mounted on a single shaft. The design working fluid was a helium–xenon mixture with a molecular weight of 83.8. The results of actual and simulated test runs are compared. The variation of rotative speed with time during injection starts is shown as a function of injection rate, turbine inlet temperature, and initial test loop pressure. Author

N69-33437*# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.

DEVELOPMENT OF A FILAMENT WOUND CASE DESIGN FOR SOLID PROPELLANT ROCKET MOTORS IN THE 260-INCH DIAMETER CLASS Final Report

C. W. Vogt Mar. 1969 215 p refs

(Contract NAS3-10287)

(NASA-CR-72565; TWR-3293) Avail: CFSTI CSCL 21H

A program to develop technology for the design and fabrication of a 260 in. diameter fiberglass motor case is reported. During the course of the program, technology specifically in the areas of skirt attachment and aft dome designs was investigated. Skirt loads up to 17,900 lb/in. and domes with port openings up to 70 percent of chamber diameter were successfully demonstrated. The program consisted of: (1) the design and fabrication of ten 18 in. diameter subscale vessels, and (2) the design and fabrication of one 64 in. diameter vessel with a 70 percent aft port opening and a 15,000 lb/in. minimum skirt load. All vessels were filament wound with epoxy impregnated S-994 glass roving. Both helical and planar winding patterns were evaluated. In conjunction with the polar winding pattern, aft domes with tape reinforcements and cut openings were evaluated. Author

N69-33566*# United Aircraft Corp., East Hartford, Conn. Research Labs.

STUDY OF HYDRAZINE REACTOR VACUUM START CHARACTERISTICS Quarterly Progress Report, 1 May–31 Jul. 1969

J. J. Sangiovanni, J. D. Rockenfeller, and A. S. Kesten 15 Aug. 1969 47 p refs

(Contract NAS7-696)

(NASA-CR-103886; H910759-9; QPR-3) Avail: CFSTI CSCL 21H

Work included completing both the experimental investigation of liquid hydrazine penetration into individual catalyst particles upon sudden immersion into liquid hydrazine and the experimental studies of the kinetics of hydrazine gas decomposition within porous catalyst particles. The computer program for solving the mathematical equations describing the liquid penetration model was modified to account for the variation of fluid properties and diffusion coefficients as a function of time. In addition, the checkout and pulse width surveys of the series of instrumented vacuum test firing of hydrazine engines were completed. Author

N69-33597*# Thiokol Chemical Corp., Denville, N.J. Reaction Motors Div.

OXYGEN FLUORIDE/DIBORANE THRUST CHAMBER ASSEMBLIES Final Report

L. Van Der Jagt 17 Apr. 1969 99 p Prepared for JPL

(Contracts NAS7-100; JPL-952298; RMD Proj. 6062)

(NASA-CR-103837; RMD-6062-F) Avail: CFSTI CSCL 21H

The program to design, fabricate and deliver thrust chamber assemblies for evaluation with OF_2/B_2H_6 propellant combination is presented. The unique thrust chamber approach selected to fulfill the specified requirements is termed the radiabatic concept. This thrust chamber approach provides increased chamber durability over a wide range of operating conditions with the presently operational and advanced high energy, high flame temperature propellants. The radiabatic concept employs solid pyrolytic graphite pieces as the chamber heat transfer medium analagous to the propellant coolant of a regenerative engine design. In the nozzle region, the heat input from the combustion gases is partially transferred by conduction through the heat pipes of anisotropic pyrolytic graphite, arranged to provide high radial and axial conductivity so that the heat is conducted forward toward the injector, where it is rejected to the cool boundary provided by the injector. Author

N69-33706# European Space Vehicle Launcher Development Organization, Paris (France).

POTENTIALITIES OF NON-CHEMICAL PROPULSION IN EUROPE

J. P. Contzen May 1969 13 p refs Presented at the 9th European Space Symp., London, 14–16 May 1969

(ELDO-Publ-19) Avail: CFSTI

The paper examines possible early applications of non-chemical propulsion in the frame of a future European space programme. Performances of nuclear and electrical propulsion systems are evaluated in relation with projected launch capability and foreseeable missions; particular attention is given to the geostationary orbit application. Technological advances required by such systems are underlined. Author (ESRO)

N69-33776# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

ANALYSIS OF THREE-DIMENSIONAL SCRAMJET EXHAUST NOZZLE FLOW FIELDS BY A NEW SECOND-ORDER METHOD OF CHARACTERISTICS

V. H. Ransom, H. Doyle Thompson, and J. D. Hoffman New York AIAA [1969] 11 p refs Presented at the 7th AIAA Aerospace Sci. Meeting, New York, 20–22 Jan. 1969 Sponsored by AF AIAA Paper 69-5

(AD-685981) Avail: CFSTI CSCL 21/5

In this paper a new second-order numerical method of characteristics for calculation of three-dimensional steady supersonic flow is described. The method has been programmed for the CDC 6500 and IBM 7094 computers. Numerical results have been obtained which verify the second order numerical accuracy and the numerical stability of the scheme. In addition, computed results for an axisymmetric nozzle are compared with the solution obtained using a two independent variable method of characteristics program and the two results are found to be in good agreement. The numerical solution for the flow in a representative three-dimensional nozzle is presented. Author (TAB)

N69-33806*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL STUDY OF LOW-SPEED OPERATING CHARACTERISTICS OF A LIQUID HYDROGEN CENTRIFUGAL TURBOPUMP
Guy H. Ribble, Jr., and George E. Turney Washington Aug. 1969 22 p refs
(NASA-TM-X-1861) Avail: CFSTI CSCL 21H

The low speed operating characteristics of a liquid hydrogen centrifugal turbopump are discussed. The turbopump was operated at several speeds, ranging from 6.7 to 49 percent of the rated speed. The rated operating speed is 22,500 rpm. At the rated flow parameter of 0.346 gallon per minute per rpm, the pump isentropic efficiencies were 9, 32, and 63 percent for speeds of 1500, 3000, and 6000 rpm, respectively. The isentropic efficiency was nearly constant for speeds above 6000 rpm. The head characteristics of the turbopump follow the affinity laws for the range of operating conditions investigated. At the pump rated flow parameter, an average total head parameter of 65×10^{-6} ft(rpm)^2 was obtained. Author

N69-33879*# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
SPACECRAFT ATTITUDE CONTROL SYSTEM, PROTOTYPE AND TEST Final Analysis and Test Report
Robert Cromwell Jul. 1968 138 p Prepared for JPL
(Contracts NAS7-100; JPL-951895)
(NASA-CR-103887; GESP-236) Avail: CFSTI CSCL 21H

The design, development, fabrication, and test of a laboratory prototype, passive vaporizing liquid ammonia attitude control system are presented. Performance tests have demonstrated the specified control and conceptual operation of a fully passive ammonia feed system coupled with attitude control thrusters. The system operates at spacecraft ambient temperatures and is composed of the following subsystems: liquid ammonia propellant storage tank with zero-g heat exchanger vaporizer intimately brazed onto the exterior; liquid throttling valve; gas pressure regulation; solenoid mounted thrusters; and inline solenoid valve. The system was designed to meet the thrust level requirements of a hypothetical spacecraft in the 14,000 slug-ft^2 class. The principal system feature is the passive zero-g feed system which draws the needed thermal energy for the latent heat of vaporization of the liquid ammonia from the liquid ammonia sensible heat and spacecraft waste heat. Author

N69-34111# Rocket Propulsion Establishment, Westcott (England).
CHEMICAL EROSION OF GRAPHITE ROCKET NOZZLES
G. A. Heath and R. W. Thackray 1969 11 p refs Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 9–11 Apr. 1969
Avail: CFSTI

The work reported here represents only the first stage of a program to explore the erosion of graphite nozzles over a very wide range of operating conditions and to test the validity of the various proposed models. There is still a requirement for accurate experimental data on gas-solid reactions at high temperature and high pressure otherwise no progress will be made. From a practical view point there is a need for graphites with improved oxidation resistance under rocket nozzle conditions. Further studies of the relationship between structure and reactivity could lead to this improvement. Author (ESRO)

N69-34303# Oak Ridge National Lab., Tenn.
EFFECTS OF STAGE TEMPERATURE DROP ON THERMAL STRESSES IN REPRESENTATIVE CESIUM AND POTASSIUM TURBINES
M. E. LaVerne and T. T. Robin Nov. 1968 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2125) Avail: CFSTI

Turbine reference designs for both potassium and cesium systems were analyzed for thermal stresses. Detailed temperature distributions for the rotors were calculated with a finite-difference computer code. Order of magnitude thermal stress estimates indicated that the most severe stresses would occur in the hub region between the first stage rotor and its adjacent bearing in the four-bearing machines, and that these stresses would be well below the 20,000 psi maximum allowable for TZM at 2100°F. Detailed analyses of these components using a code based on the finite element method showed actual thermal stresses in this region of the order of 2000 psi. Order of magnitude estimates for the stators and other components also indicated thermal stresses below the maximum allowable. Author (NSA)

N69-34345# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ESTIMATION OF THE MAXIMUM POSSIBLE PRESSURE IN AN OXYGEN-HYDROGEN ENGINE
M. V. Dobrovolskii Feb. 1969 8 p Transl. into ENGLISH from Izv. Vysshikh Uchebn Zavednii, Mashinostr. (Moscow), no. 5, 1968 p 100–103
(AD-687240; FTD-HT-23-1116-68) Avail: CFSTI CSCL 21/8.1

An analytical method is presented for estimating approximately the maximum possible pressure in an engine chamber using a closed system with a turbopump drive. Hydrogen, which is heated in the chamber cooling circuit, is used as the working medium. Calculations indicate that at the actual efficiency of the pumps and the turbine, it is difficult to achieve a pressure higher than 40-50 ata in the engine system. This limitation is mainly due to the low hydrogen heating temperature values (200-270K) in the cooling circuit. Author (TAB)

N69-34508# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
DESIGN AND EVALUATION OF A HIGH TEMPERATURE RADIAL TURBINE Quarterly Technical Summary Report No. 7, 1 Feb.–30 Apr. 1969
G. S. Calvert May 1969 25 p
(Contract DAAJ02-68-C-0003)
(AD-688653; PWA-FR-3231) Avail: CFSTI CSCL 21/5

Detail design of hot turbine was concluded. Casting development and fabrication of hot turbine consisted primarily of tooling procurement for the turbine nozzles and rotors. The contractor-furnished castings are being finish-machined. The combustor test portion of the hot tests was initiated with Builds 1, 2, 3 and 4 being tested. Results showed unacceptable temperature distributions and a persistent coking problem. At the end of the report period, four rig/facility modifications were being implemented to improve the coking situation, which would then allow efforts to be directed toward improving the temperature pattern. Author (TAB)

N69-34575*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AERODYNAMIC CHARACTERISTICS OF A LARGE-SCALE 1.075-PRESSURE-RATIO TIP-TURBINE CRUISE-FAN PROPULSION SYSTEM AT ANGLE OF ATTACK
Francis J. Capone Washington Aug. 1969 64 p refs
(NASA-TN-D-5316) Avail: CFSTI

Aerodynamic characteristics and pressure distributions of a large-scale 1.075-pressure-ratio tip-turbine cruise fan at angle of attack were studied in the 16-foot transonic tunnel. The purpose was to determine trends rather than absolute levels in performance since the fan was originally designed as a low-pressure-ratio lift

fan. The gas generator was closely coupled to the fan so that the gas-generator nacelle extended forward and below the fan nacelle. The investigation was conducted at Mach numbers of 0.30, 0.50, and 0.70 and at angles of attack from −2° to 8°. The test Reynolds number based on the fan diameter (91.44 cm) varied from 3.90×10^6 to 11.25×10^6. Angle-of-attack variation affected only the external pressure distributions at the fan-cowl leading edge. Premature supercritical flow occurred on the fairing between the fan and gas-generator nacelles at angles of attack of 2° and 5° at a Mach number of 0.70, well below the fan-nacelle design Mach number of 0.81. Nacelle minimum drag occurred at an angle of attack of 2°, and both the lift and pitching-moment curves were linear over an angle-of-attack range of −2° to 5° throughout the Mach number range of the test. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-33401*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

SOLAR ACTIVITY, NO. 3 Collection of Articles

E. R. Mustel, ed. et al Washington NASA Jul. 1969 193 p refs Transl. into ENGLISH of the publ. "Solnechnaya Aktivnost. Sbornik Statey. No. 3" Moscow, Nauka Press, 1968 p 5–147 (Contract NASw-1692) (NASA-TT-F-581) Avail: CFSTI CSCL 04A

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N69-33402*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

FORCELESS STRUCTURE OF MAGNETIC FIELDS IN THE ATMOSPHERE OF ACTIVE SOLAR REGIONS AND PROBLEMS OF THE GENERATION OF GEOEFFECTIVE CORPUSCULAR STREAMS

E. I. Mogilevskiy *In its* Solar Activity, No. 3 Jul. 1969 p 1–38 refs (See N69-33401 19-29)

Avail: CFSTI CSCL 04A

The results of a number of studies conducted on the nature of the magnetic fields of solar active regions, in connection with problems concerning the generation of geoeffective corpuscular streams, are presented. The probable forceless structure of the magnetic fields in the chromosphere and in the corona is dicussed. Two types of magnetic fields in the chromosphere are analyzed, including those associated with the photosphere and those which are isolated and have their own forceless structure. The conditions which must correspond to the formation and emission of geoeffective corpuscular streams from the active regions are analyzed. A semi-quantitative scheme proposed for the generation of discrete plasmoids from the active regions is found to satisfy the conditional requirements. Author

N69-33403*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

SIMULTANEOUS MEASUREMENT OF MAGNETIC FIELDS AT TWO LEVELS IN THE SOLAR ATMOSPHERE

I. A. Zhulin et al *In its* Solar Activity, No. 3 Jul. 1969 p 39–50 refs (See N69-33401 19-29)

Avail: CFSTI CSCL 04A

Simultaneous measurements of the magnetic fields in the photosphere and chromosphere using a two-channel solar magnetograph are described. The instrument features the simultaneous operation of two magnetographs on one spectrograph sent by a solar tower telescope. One magnetograph uses the photospheric Fe I line (5250.2 (5250.2 Å), while the other uses the chromospheric Hβ line (4861 Å). The possibility of using both wings of the Hβ line is analyzed, and the existence of other magnetosensitive chromospheric lines is examined. Results are given in terms of magnetic field patterns in the chromosphere and photosphere. Author

N69-33404*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

MEASUREMENT OF MAGNETIC FIELDS IN PROMINENCES AND THE STRUCTURE OF THE MAGNETIC FIELD IN THE REGION OF CHROMOSPHERIC FILAMENTS

B. A. Ioshpe *In its* Solar Activity, No. 3 Jul. 1969 p 51–76 refs (See N69-33401 19-29)

Avail: CFSTI CSCL 04A

Results of measurements of the magnetic fields in solar prominences are given, and the structure of the magnetic fields in

areas of the solar disk having chromospheric filaments are investigated. The studies were conducted during the period from 1961 to 1963, using the H_β line. Results are tabulated for 12 prominences, and show the existence of magnetic fields up to several gauss. In rare cases, considerable fields ($\approx$ 100 gauss) were observed in prominences which had no apparent connection with the active region on the disk. A hypothesis is suggested for the existence of two field systems in the region of chromospheric filaments. One system consists of an outer field lying at the top of the arched filament structure and perpendicular to the filaments, while the other system consists of an inner field directed along the filaments. Author

N69-33405*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
MAGNETIC-FIELD RADIATION-SCATTERING MATRIX DERIVED WITH ALLOWANCE FOR THE PHASE COUPLINGS OF THE UPPER-LEVEL WAVE FUNCTION
V. N. Obridko *In its* Solar Activity, No. 3 Jul. 1969 p 77–85 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

A calculation of the matrix of resonance scattering when there is an outer magnetic field is presented, with allowance for phase coupling of upper-level wave functions for lines with $j_b = 0$ and $j_b = 1$. The problem of the limit transition $H \rightarrow 0$ is discussed. Author

N69-33406*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
APPLICABILITY OF THE EXISTING THEORIES OF THE FORMATION OF SPECTRAL LINES IN A MAGNETIC FIELD FOR QUANTITATIVE INTERPRETATION OF SOLAR MAGNETOGRAPH READINGS
V. N. Obridko *In its* Solar Activity, No. 3 Jul. 1969 p 86–94 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

Problems in the theory of the formation of the Fe II spectral lines (5250 Å), which is generally used in photoelectric observations of the magnetic field in active solar regions, were investigated. The applicability of various theories to the calibration of magnetograph readings is evaluated, and the dependence of the obtained values of magnetic field components on the assumptions of the particular theory is examined. The theories considered include one which proposes an intrinsic-absorption mechanism of emission and another that assumes a simplified scattering scheme and discontinuous absorption. It is shown that, within the limits of accuracy of the currently available magnetographs, both theories yield corresponding results and may be used equally for calibration. Author

N69-33407*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
FACULA STRUCTURE
M. A. Livshits *In its* Solar Activity, No. 3 Jul. 1969 p 95–106 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

The values obtained for facula contrast (the ratio of the facula emission intensity to that of the undisturbed chromosphere) are compared to those obtained by photoheliograms and by spectral observation. Earlier measurements were repeated by using modern photographs of the photosphere in the blue region of the spectrum for the same values of θ (the angle between the normal to the surface and the line of sight). A comparison of the results with those obtained by spectral measurements confirmed the accuracy of the values for the facula contrast. The obtained dependence of the contrast on the angle θ is used to construct a model of the facula with the aid of a numerical method. It is shown that the integral emission of the facula filaments exceeds that of the photosphere by 2–3%. Author

N69-33408*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE AREA VARIATION CURVE AND THE LIFETIME OF CHROMOSPHERIC FLARES
S. O. Obashev *In its* Solar Activity, No. 3 Jul. 1969 p 107–117 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

Characteristic peculiarities of the photometric curves for the brightness of a chromospheric flare are discussed. Ratios are obtained between the area and the duration, as well as for the relaxation time of a chromospheric flare. Author

N69-33409*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
TOTAL ENERGY OF CHROMOSPHERIC FLARES
S. O. Obashev *In its* Solar Activity, No. 3 Jul. 1969 p 118–121 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

An evaluation is made of the total energy of a chromospheric layer. The total energy is found to be proportional to the total period of the flare, to the power 5/2. Author

N69-33410*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ENERGY CLASSIFICATION OF CHROMOSPHERIC FLARES
C. O. Obashev *In its* Solar Activity, No. 3 Jul. 1969 p 122–124 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

An empirical evaluation is made of the total energy of chromospheric flares of different intensities. The dependence of the maximum area and the total duration of the flares is taken into account. Author

N69-33411*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
CONTOURS OF THE Mg I b SUB 1 TO b SUB 4 AND Sr II 4216 AND 4078 ANGSTROM LINES IN THE CHROMOSPHERE
N. S. Shilova *In its* Solar Activity, No. 3 Jul. 1969 p 125–129 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

The mechanism responsible for the shapes of the contours of the chromospheric lines of neutral magnesium (5184 and 5173 Å) are analyzed. It is shown that the shape of optically thick lines of the chromosphere is not determined by photospheric radiation scattering. The intrinsic radiation of the chromosphere must be known in order to explain the observed shape. Author

N69-33412*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
HELIUM IONIZATION AND THE EXCITATION OF ORTHOHELIUM IN THE SOLAR ATMOSPHERE
R. A. Gulyayev *In its* Solar Activity, No. 3 Jul. 1969 p 130–146 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

The concentration of He I, He II and He III in the solar atmosphere is calculated. In addition, the population of the lower levels of orthohelium, as a function of kinetic temperature and electron density, is computed. The calculation is based on available

experimental data for the effective cross sections of elementary processes not previously considered. Particular attention is given to the two limiting cases where (1) the ionizing radiation field (504 Å) is absent and helium ionization is accomplished only by electron impact; and (2) the helium atoms are ionized by the coronal emission. Author

N69-33413*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SHAPE OF THE CONTOURS OF THE α LINE IN PROMINENCES
M. Yu. Zaldina *In its* Solar Activity, No. 3 Jul. 1969 p 147–156 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

The dependence of the contour of the Hα emission line on the height of the solar prominence over the limb and on its orientation relative to the line of sight and to the normal to the solar surface is determined. A thin homogeneous sheet perpendicular to the solar surface is assumed as a model of the prominence. An integral equation is solved for the radiation diffusion for the total energy redistribution with respect to frequency in an elementary scattering event. Contours of the Hα line emitted by prominences and filaments are obtained under the assumption that Hα glow is caused by scattering of the photospheric radiation. Author

N69-33414*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SPECIAL PHOTOMETRY OF THE CHROMOSPHERIC FLARE OF 12 JULY 1961
P. N. Polupan *In its* Solar Activity, No. 3 Jul. 1969 p 157–172 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

A table is compiled according to the results of a photometric analysis of the spectrum of a flare on July 12, 1961. The table contains the central intensities and equivalent widths of 918 spectral emission lines. Author

N69-33415*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE SYNCHRONISM OF ACTIVE FLUCTUATIONS OF THE OLD AND NEW CYCLES IN THE INTERMEDIATE EPOCH
V. S. Chistyakov *In its* Solar Activity, No. 3 Jul. 1969 p 173–182 refs (See N69-33401 19-29)
Avail: CFSTI CSCL 04A

An analysis of the solar activity in the intermediate epoch shows that the monthly activity fluctuations develop synchronously at high latitudes (old cycles) and low latitudes (new cycles). The strict synchronization of the fluctuation peaks before the minimum, and the appearance of the high-latitude groups of the new cycle are maintained only on the condition that the heliographic latitude of these groups of spots is close to 24.3. During an increase of the heliographic latitude of groups of the new cycle, this synchronization is observed in the activity of the high and low latitudes. The results obtained suggest that the sun has a special mechanism of short-period oscillations which act continually and independently in the 11-year cycle phase. Author

N69-33435*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW ENERGY COSMIC RAY POSITRONS AND 0.51 MeV GAMMA RAYS FROM THE GALAXY
R. Ramaty, F. W. Stecker, and D. Misra Jul. 1969 25 p refs
(NASA-TM-X-63620; X-611-69-287) Avail: CFSTI CSCL 04A

Large fluxes of low-energy cosmic rays in interstellar space may produce, via unstable CNO beta-emitters, large fluxes of low-energy positrons and a detectable intensity of 0.51 MeV gamma rays. Even though on a galactic scale these cosmic-ray intensities are probably untenable since they conflict with the dynamics of the interstellar medium, they may exist on a smaller scale of the order of the stopping distances of both low-energy cosmic rays and positrons. Results are compared of a detailed calculation with direct positron measurements at the earth, and the observability of the annihilation radiation above the isotropic X-ray background is discussed. Author

N69-33438*# New Hampshire Univ., Durham. Dept. of Physics.
RESEARCH FOR THE MEASURING OF NEUTRON INTENSITY IN SPACE Final Report
J. A. Lockwood Jun. 1969 188 p refs
(Contract NASr-164)
(NASA-CR-103825) Avail: CFSTI CSCL 04A

The results of measurements are reported of (1) the fast neutron flux and energy spectra near the top and above the earth's atmosphere, and (2) the electron density in the ionosphere. Observations were made both on rocket and balloon flights at several different epochs and at a range of geographic latitudes. Included are measurements of solar X-rays and solar ultraviolet radiation. Also contained in the report is a collection of all the publications pertaining to the above investigations which are arranged chronologically and are divided into two groups: cosmic-ray neutron and ionospheric measurements. Author

N69-33548*# California Univ., Berkeley. Lawrence Radiation Lab.
MATHEMATICAL MODELING OF SPACE RADIATION HAZARDS
Palmer G. Steward and Cornelius A. Tobias *In its* Joint NASA-AEC Program in Space Radiation Biol. Sep. 1967 p 137–141 refs (See N69-33527 19-04)
Avail: CFSTI CSCL 06R

A simplified mathematical model is described, based on the Gompertz mortality formula, responding to constants measurable in radiobiological experiments, stating overall results from animals to man, and yielding an index for the magnitude of injury following a known dose schedule. K.R.G.

N69-33574*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASTROPHYSICAL AND GEOPHYSICAL VARIATIONS IN C 14 PRODUCTION
Richard E. Lingenfelter (Calif. Univ., Los Angeles) and Reuven Ramaty Jul. 1969 47 p refs Presented at the 12th Nobel Symp. on Radiocarbon Variations and Absolute Chronology, Uppsala, 11-15 Aug. 1969
(NASA-TM-X-63615; X-611-69-300) Avail: CFSTI CSCL 04A

The production rate of carbon-14 was renormalized based on new atmospheric neutron measurements and on cosmic ray and ionization monitor records. The best calculation of production rate and decay of carbon-14 was obtained from carbon-14 variations determined from dendrochronology. Differential equations are presented for carbon-14 activity. It was shown that the major component of these variations can be understood in terms of measured geomagnetic fields. Shorter time variations may result from solar modulated cosmic rays, solar flare particles, and possible supernova gamma rays, while longer time variations may reflect change in cosmic ray flux. J.M.C.

N69-33689# Oak Ridge National Lab., Tenn.
VAN ALLEN RADIATION BELTS
Philippe Touzain [1968] 33 p refs Transl. into ENGLISH from French Rept. CEA-Bib-103
(ORNL-TR-1920; (CEA-Bib-103) Avail: CFSTI

The Van Allen radiation belts are studied with the bibliography results published before May 1967. The trapped particles motion in the magnetosphere, their origins and their disappearances, the position in space of electron and proton zones, and finally, the 1962 nuclear explosions and South-Atlantic anomaly influence, are successively examined. Author (NSA)

N69-33764# Liege Univ. (Belgium). Inst. d'Astrophysique.
ESTIMATED INTENSITIES OF SOME EMISSION LINES OF AN A-TYPE AURORA IN THE WAVELENGTH REGION BELOW 1000 Å
F. Fischer Paris ESRO Jan. 1969 11 p refs Sponsored by ESRO
(ESRO-SM-76) Avail: CFSTI

The spectrum of the auroral ultraviolet below 1000 Å should consist of ionized atomic oxygen, ionized atomic nitrogen lines, the molecular Birge-Hopfield system and the Watson-Koontz system. The intensities of some atomic lines were estimated to see whether they were high enough for recording with a spectrometer. Author (ESRO)

N69-33809# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF COSMIC RADIATION ON THE OPERATION OF AIRCRAFT
I. I. McNaughtan Dec. 1968 39 p refs
(RAE-TR-68286) Copyright. Avail: CFSTI

Data are presented on the variation of cosmic radiation dose-rate with altitude, latitude and solar cycle time. An assessment is made using this data of the effect of cosmic radiation on aircraft operation and it is concluded that: (1) The radiation has no effect on current subsonic operations below 40,000 ft. (2) Supersonic transport aircraft flying on high latitude routes will require to be operated under the direction of a solar radiation warning instrument or system, and the necessity for the crews of such aircraft to be classified as radiation workers should be considered by the appropriate medical authorities. (3) The operation of hypersonic transport aricraft may not be acceptable unless studies of the biological effects of the heavy particle flux show the hazard is acceptable and a fully effective solar cosmic radiation forecast service is developed. Author (ESRO)

N69-34017# International Centre for Theoretical Physics, Trieste (Italy).
THE INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS Fourth Annual Report, 1967–1968
Nov. 1968 85 p refs
Avail: CFSTI

This annual report of the International Centre for Theoretical Physics, Trieste, contains a summary of research activities on nuclear spectroscopy, the BCS gap equation, the application of Hartree-Fock approximation to light nuclei, sum rules in high-energy physics, symmetry in high-energy scattering, quarks and high energies, quantum field theory, group representations, scattering theory, current algebra and some fundamental work on the philosophy of science. ESRO

N69-34085# Kiruna Geophysical Observatory (Sweden).
POLAR MAGNETIC SUBSTORMS
Bengt Hultqvist Apr. 1969 31 p refs
(KGO-693) Avail: CFSTI

IGY and satellite data show that an electric jet current flows westward along the auroral oval rather than along the auroral zone and produces a negative bay close to the auroral oval. Akasofu assumed that return currents were responsible for the positive bays observed on the evening side of the Earth, but recent satellite measurements support a two-cell current system. DP 1 and DP 2 equivalent current systems are described and discussed. In auroral zone latitudes the currents giving rise to bays flow in the direction of elongated auroral forms, but in the polar cap regions the currents flow 30°–60° away from the auroral arc directions and more experiments are required to resolve this apparent discrepancy. Recently field-aligned currents have been invoked to account for some auroral phenomena and the effect of such currents on magnetosphere models is considered. The dynamics of polar magnetic substorms, including break-up, westward travelling surges and auroral oval dimensions are discussed in detail. The role of the southward component of the interplanetary field in DP 1 and DP 2 variations is also considered as well as the magnetic effects in the magnetospheric tail that are associated with polar magnetic substorms. Author (ESRO)

N69-34247# Los Alamos Scientific Lab., N.Mex.
THE LASL–SANDIA ROCKETBORNE STUDY OF VACUUM ULTRAVIOLET AND VISIBLE EMISSIONS IN AURORAS
Karl Theobald and H. Milton Peek 18 Apr. 1969 11 p refs
(Contract W-7405-eng-36)
(LA-3929) Avail: CFSTI

Instrumentation consisted of a scanning spectrometer for the 1150- to 1650-Å wavelength range; a filter-wheel photometer for 3914-Å first negative N^+_2, 4059-Å second positive N_2, and 5577- and 6300-Å atomic oxygen; and an electron spectrometer that failed. Good altitude profiles were obtained for all wavelengths until the filter-wheel photometer failed at 140 km. The total maximum photon flux density in this system was derived from five observed bands. From the 3914- and 4059-Å data, the total maximum flux densities were derived for the first negative N^+_2 and second positive N_2 systems. The total measured photon flux in the vacuum ultraviolet was roughly equal to that in all visible bands and lines, indicating substantially greater energy radiated in the ultraviolet Emissions at 3914, 4059, and 5577 Å have the same altitude dependence. When corrected for absorption by O_2, the Lyman–Birge–Hopfield emission has the same altitude dependence as N^+_2 first negative. Comparison of measurements with calculations leads to the conclusion that cascading through the Janin and Gaydon–Herman bands into the upper state of the Lyman–Birge–Hopfield bands was not significant in this aurora. Author (NSA)

N69-34296# Air Force Cambridge Research Labs., Bedford, Mass.
FLARE OCCURRENCE TOMORROW AS A FUNCTION OF AREA AND FLARINESS OF SUNSPOT TODAY
Alfred E. Reilly, Isadore Enger, and Abraham Pavlowitz Apr. 1969 17 p refs /*ts* Surv. in Geophys. No. 210
(AD-687745; AFCRL-69-0148) Avail: CFSTI CSCL 3/2

An objective technique has been developed for estimating the probability of occurrence of solar flares in a particular sunspot group using both the size of the sunspot group and its flariness. Tables are given which indicate the probability that at least one flare of importance two or greater will occur tomorrow, given the area and flariness of the sunspot group today. Author (TAB)

N69-34330# Atomic Weapons Research Establishment, Aldermaston (England).
RADIOLOGICAL DOSE TO THE SST CONCORDE FROM GALACTIC COSMIC RAYS

E. W. Fuller and N. T. Clarke Dec. 1968 22 p refs
(AWRE-O-64/68) Avail: CFSTI; UK 3s 3d

The radiological dose rate due to galactic cosmic rays was measured at a place of high geomagnetic latitude during the 1964 solar minimum to obtain the maximum value of the steady radiation level in which the SST Concorde will operate. Ionization chambers, neutron Rem meters, and nuclear emulsions carried to 65,000 ft by balloons were used for the measurements. It was concluded that the maximum value of the dose rate is 2.2 mRem/h and hence that the dose from galactic cosmic rays would not be a limiting factor in the operation of the Concorde. Author (NSA)

N69-34374# Franklin Inst., Swarthmore, Pa. Bartol Research Foundation.
NUCLEAR PHYSICS AND COSMIC RADIATION Final Report, 1968
Martin A. Pomerantz May 1969 16 p refs
(Contract Nonr-3777(00))
(AD-687518) Avail: CFSTI CSCL 20/8

A historical summary providing a broad overall view of the nuclear physics and cosmic ray research is reported. Described are the modifications to the Van de Graaff accelerator to function as an electron accelerator so that bremsstrahlung is used as a source for resonant fluorescence. Publications are listed. F.O.S.

N69-34536*# California Inst. of Tech., Pasadena.
NEW MEASUREMENTS OF THE ABSOLUTE COSMIC RAY IONIZATION FROM SEA LEVEL TO 1540 KILOMETERS ALTITUDE
Michael James George (Ph.D. Thesis) 25 Apr. 1969 174 p refs
(Contracts NAS 5-3095; NAS5-9317; NAS7-100; Grant NGL-05-002-007; Contract Nonr-220(53))
(NASA-CR-104068) Avail: CFSTI CSCL 03B

The construction of an air filled ionization chamber is described. This chamber was flown along with an older, argon filled, balloon type chamber in a C-135 aircraft from 1,000 to 40,000 feet altitude, and other measurements of sea level cosmic ray ionization were made. The calibrations of the two instruments were found to agree within 1 percent, and the airplane data were consistent with previous balloon measurements in the upper atmosphere. Ionization due to radon gas in the atmosphere was investigated. Absolute ionization data in the lower atmosphere have been compared with results of other observers, and discrepancies have been discussed. Also, data from a polar orbiting ion chamber on the OGO-2, 4 spacecraft have been analyzed. The problem of radioactivity produced on the spacecraft during passes through high fluxes of trapped protons has been investigated, and some corrections determined. Author

N69-34540*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF POST STORM NON-ADIABATIC RECOVERY OF TRAPPED PROTONS WITH RADIAL DIFFUSION
Finn Soeraas Jun. 1969 24 p refs
(NASA-TM-X-63625; X-612-69-241) Avail: CFSTI CSCL 03B

During magnetic storms it has been observed that the geomagnetically trapped protons undergo rapid nonadiabatic changes followed by slow nonadiabatic recovery approaching the pre-storm values. The slow nonadiabatic recovery can be accounted for in a semiquantitative way by solving a time dependent Fokker–Planck equation with radial transport and loss terms describing Coulomb energy degradation and charge exchange. The equation is solved numerically in a region of space where measurements are available of the 100 keV to 1700keV protons mirroring at the equator. Author

N69-34548*# Bellcomm, Inc., Washington, D.C.
COSMIC RAY AND HIGH ENERGY PHYSICS STUDIES IN SPACE
L. Kaufman 1 Apr. 1969 49 p refs
(Contract NASw-417)
(NASA-CR-104069; TR-69-103-1) Avail: CFSTI CSCL 03B

The design of a space facility that can perform relevant measurements on the primary cosmic ray flux in the energy range from a few GeV to 10^{3}GeV is presented. It is shown that a small increment in the instrumentation of a cosmic ray space station, together with the versatility provided by the presence of man rearranging and servicing the hardware, could give us an experimental facility that would also provide vital information in the field of high energy physics. Hardware appropriate for space use is described, and various configurations with a large superconducting magnet as the central element are shown. The magnet's capabilities are compared to those of ionization calorimeters. The implementation of this program is intimately tied to the techniques and needs of accelerator-directed high energy physics, and the involvement of the high energy physics community in this project is presented as a necessary ingredient for its worthiness. Author

N69-34552# France. Direction de la Meteorologie Nationale, Paris.
GENERALITIES ON SOLAR AND TERRESTRIAL RADIATIONS [GENERALITES SUR LES RAYONNEMENTS SOLAIRE ET TERRESTRE]
C. Perrin de Brichambaut *In* Assoc. Franc. Etude et Develop. Appl. Energie Solaire Solar Radiation Meas. and Radiative Heat Transfer 1968 9 p In FRENCH (See N69-34551 19-30)
Avail: CFSTI

A lecture published elsewhere is briefly summarized and definitions relating to solar and terrestrial radiations are given. The radiation balance of the earth and its atmosphere as a whole are discussed and the implications for long term weather forecasting are analyzed. ESRO

N69-34553# Centre National de la Recherche Scientifique, Bellevue (France). Laboratoire des Echanges Thermiques.
SPECTROMETRIC METHODS FOR MEASURING RADIATION [METHODES SPECTROMETRIQUES DE MESURE DES RAYONNEMENTS]
M. F. Cabannes *In* Assoc. Franc. Etude et Develop. Appl. Energie Solaire Solar Radiation Meas. and Radiative Heat Transfer 1968 28 p In FRENCH (See N69-34551 19-14)
Avail: CFSTI

The problem is limited to high temperature radiation and continuous emission spectra. The methods in use are discussed and the difficulties encountered are listed. The importance of surface conditions are stressed and some radiation sources that can be used for calibration are indicated. ESRO

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-33212*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE CAPTURE AND ESCAPE BEHAVIOR OF PLANET/MOON SYSTEMS [DAS EINFANG-UND KATAPULVERMOEGEN VON PLANET/MOND-SYSTEMEN]

O. Bschorr et al. Washington NASA Jul. 1969 37 p refs Transl. into ENGLISH of report DLR-FB-68-81; DVL-795 (Contract NASw-1692)
(NASA-TT-F-12330; DLR-FB-68-81; DVL-795) Avail: CFSTI CSCL 22A

The flyby technique is an effective means of reducing thrust and time of interplanetary missions. The flyby behavior for planet/moon systems investigated in view of flights to planets. The velocity gains and the conditions for capture and escape are calculated. The maximum capture velocity of a Jupiter/Ganymede flyby is 4.5 km/sec. Probably, the irregular moons of Jupiter, Saturn and Neptune have been captured by a flyby process. Author

N69-33264*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROJECT ENGINEERING DIVISION
In its Supporting Res. and Advanced Develop. 30 Apr. 1969 p 1–7 refs (See N69-33263 19-31)
Copyright. Avail: CFSTI CSCL 03B

The state-of-the-art atmospheric environmental criteria for Mercury is described by definitions of structure, composition, and dynamics of the planet's atmosphere. Examples of the various atmospheric environmental interactions and pertinent parameters that influence the design of a planetary vehicle are given and a set of detailed Mercury atmospheric models for use in space vehicle development is formulated. A new numerical model for the distribution of asteroid debris in the interplanetary environment and the degrees of hazard involved is developed and used to determine spacecraft shielding requirements. G. G.

N69-33278*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE MARINER 5 FLIGHT PATH AND ITS DETERMINATION FROM TRACKING DATA
G. Pease, R. Bourke, S. McReynolds, K. Thuleen, J. Borras et al 1 Jul. 1969 57 p refs
(Contract NAS7-100)
(NASA-CR-103716; JPL-TR-32-1363) Avail: CFSTI

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1. ORBIT DETERMINATION FROM DSIF TRACKING DATA G. Pease p 1–26 (See N69-33277 19-30)

2. NONGRAVITATIONAL FORCES R. D. Bourke, S. R. McReynolds, and K. L. Thuleen p 27–30 (See N69-33278 19-31)

3. MISSION TRAJECTORY J. A. Borras p 31–45 (See N69-33279 19-30)

4. MIDCOURSE MANEUVER PROGRAM R. T. Mitchell p 46–47 refs (See N69-33280 19-08)

N69-33277*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ORBIT DETERMINATION FROM DSIF TRACKING DATA
G. Pease *In its* The Mariner 5 Flight Path and its Determination from Tracking Data 1 Jul. 1969 p 1–26 (See N69-33276 19-30)
Avail: CFSTI CSCL 22C

The real orbit determination activity during the Mariner 5 mission is described. The mission is divided into three phases: premaneuver, cruise, and encounter. Analysis of the orbital tracking data provided the information for the midcourse maneuver for achieving the desired encounter with Venus. Tables for each phase of the mission are included. F.O.S.

N69-33279*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION TRAJECTORY
J. A. Borras *In its* The Mariner 5 Flight Path and its Determination from Tracking Data 1 Jul. 1969 p 31–45 (See N69-33276 19-30)
Avail: CFSTI CSCL 22C

The Mariner 5 trajectory is studied. After 13.8 minutes of coasting parking orbit, a second ignition of the Agena engines was ordered by ground control to set the Mariner 5 spacecraft on a near Venus trajectory. After the midcourse maneuver, the spacecraft guidance system required the Sun and Canopus and continued on the cruise mode. Charts summarizing the trajectory data of the Mariner 4 and 5 flights are included. F.O.S.

N69-33283*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESCRIPTIVE EXAMPLES OF GRAVITY ASSISTED TRAJECTORIES
James B. Eades, Jr. Jul. 1969 2 p refs
(NASA-TM-X-63621; X-643-69-297) Avail: CFSTI CSCL 22C

Two approximate methods for calculating the planetary swing-by maneuver are presented. These schemes may be used to determine, analytically, the path of motion, time of motion, energy and velocity change as experienced by a satellite prior, during and often after the encounter. Also, an examination for the extremals of the energy and velocity changes is discussed as a part of the overall swing-by problem. Author

N69-33490*# General Dynamics/Fort Worth, Tex.
SPACE FLIGHT HANDBOOKS, VOLUME 3. PLANETARY FLIGHT HANDBOOK, PART 7: DIRECT TRAJECTORIES TO JUPITER, SATURN, URANUS, AND NEPTUNE. GENERAL DISCUSSION, CONTOUR CHARTS AND RELATED GRAPHICAL INFORMATION
Washington NASA 1969 105 p refs
(Contract NAS2-4982)
NASA-SP-35-Vol-3-Pt-7) Avail: SOD $1.25; CFSTI CSCL 22A

This handbook contains trajectory data and a related series of charts and tables for one-way direct trajectories to Jupiter, Saturn, Uranus, and Neptune. The time period covered is for launch opportunities from 1976–1986 with the exception of trajectories to Jupiter, which span the launch opportunities from 1981 to 1986. Tables of the planetary constants used in the trajectory computations, tables of nodal crossing dates, and auxiliary charts for determining the incremental velocity requirements for departure from earth and entry into orbit at the target planets are included. Along with planetary ephemerides for the years 1970 to 2000. Hyperbolic excess speed contour charts are presented. The charts display contours of constant excess speeds at earth departure and target planet arrival on a grid of earth departure date and target planet arrival date. The appendix contains a description of a data tape which contains a complete record of the tabular trajectory data. Author

N69-33498*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
MILLIMETER-WAVE RADIOMETRY FOR RADIO ASTRONOMY Final Report
W. V. T. Rusch, S. D. Slobin, and C. A. Cooper May 1969 43 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952210)
(NASA-CR-103850; USCEE-364) Avail: CFSTI CSCL 03B

Observations were made of a lunar eclipse on 19 December 1964, a lunation study of the moon was made, instrumentation was developed, and various atmospheric effects were studied. A second lunation experiment was carried out, the sun was observed, atmospheric effects continued to be studied, and various items of instrumentation were designed and studied. Author

N69-33549*# National Aeronautics and Space Administration, Washington, D.C.
LOG OF APOLLO 11
[1969] 12 p
(NASA-EP-72; 0-356-826) Avail: SOD $0.35; CFSTI CSCL 22A

Pictorial and chronological presentation of the Apollo 11 lunar landing mission is given. A daily account of significant events which occurred between launch and recovery is provided. Pictures of man's first extravehicular lunar surface activity are included. S.P.G.

N69-33560*# Techtran Corp., Glen Burnie, Md.
MOTION OF ARTIFICIAL SATELLITES IN THE EARTH'S GRAVITATIONAL FIELD
Yu. G. Yevtushenko, I. A. Krylov, R. F. Merzhanova, and G. V. Samoylovich Washington NASA Jun. 1969 310 p refs Transl. into ENGLISH of the book "Dvizheniye Iskusstvennykh Sputnikov v Gravitatisionnom Pole Zemli" Moscow, Acad. of Sci. Computer Center, 1967
(Contract NASw-1695)
(NASA-TT-F-539) Avail: CFSTI CSCL 22C

Quantitative and qualitative analyses are used to describe the disturbing factors in the motion of artificial earth satellites due to the eccentricity of the earth's gravitational field. Pertinent equations are presented for special forms of disturbing functions in a specially selected coordinate system. Some methods for describing the motion of artificial satellites in an eccentric field of terrestrial attraction are considered. Brief consideration is given to various forces which disturb the Keplerian orbits of artificial earth satellites. J.M.C.

N69-33595*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONFERENCE ON ELECTROMAGNETIC EXPLORATION OF THE MOON, 11-13 JUNE 1968 REPORT OF THE PROGRAM EVALUATION COMMITTEE
Washington 1969 27 p refs
(NASA-SP-174) Avail: CFSTI CSCL 22A

Recommendations are made to enhance the contribution that electromagnetic methods might make to lunar exploration. Topics discussed include the purpose and goals of electromagnetic lunar work, the criteria used to evaluate proposed experiments or methods, and the role of budgetary constraints in the recommendations. Three types of experiments are proposed and include the magnetometer experiment, the radio frequency probe, and the pulsed radar probe. A description is given of these experiments together with an analysis of the necessary supporting research and technology. D.L.G.

N69-33613*# Techtran Corp., Glen Burnie, Md.
MODERN PROBLEMS OF CELESTIAL MECHANICS
G. N. Duboshin [1969] 21 p Transl. into ENGLISH from Byul. Inst. Teor. Astron (USSR), v. 2, no. 1 (124), 1967 p 1-13
(Contract NAS5-14826)
NASA-CR-101130) Avail: CFSTI CSCL 03C

This survey on celestial mechanics considers the characteristic features of: (1) natural celestial bodies belonging to the solar system; (2) artificial celestial bodies; and (3) celestial bodies outside the solar system. A general three body problem is proposed for the study of star systems, and the application of motion theories to analyze natural satellites, asteroids, comets, artificial satellites, and interplanetary spacecraft is advocated. G.G.

N69-33730*# Volt Information Sciences, Inc., Washington, D.C.
PARTICLES OF LUNAR ORIGIN. PART 1: DETERMINATION OF ELEMENTS OF GEOCENTRIC ORBITS OF LUNAR PARTICLES IN THE SPATIAL CASE
V. P. Orlov Greenbelt, Md. NASA. Goddard Space Flight Center 6 Aug. 1969 10 p refs Transl. into ENGLISH from Astronom. Vestn. (Moscow), v. 3, no. 2, 1969 p 76-81
(Contract NAS5-12487)
(NASA-CR-102882; ST-CM-LS-IM-10857) Avail: CFSTI CSCL 03A

Elements are derived of geocentric orbits of particles ejected from the moon by shock explosions of meteorites as a function of primary conditions of ejection: selenocentric longitude and latitude, initial velocity, azimuth, and the zenith distance of the direction of ejection. It is shown that the lines of nodes of geocentric orbits of particles of lunar origin are concentrated near the position of the moon at time of particle ejection. The region of the lunar surface is determined, from which vertical motion of particles toward the earth is possible. Author

N69-33784# Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
THE MYSTERY OF STRUCTURE IN THE UNIVERSE
E. R. Harrison Nov. 1968 15 p refs Presented at the Hierarchical Struct. Symp., Douglas Advan. Res. Labs and Calif. Univ., Irvine, Nov. 1968
(PB-183036; Contrib-24) Avail: CFSTI CSCL 03B

The report discusses the mystery surrounding the formation of the planets, stars, and galaxies. USGRDR

N69-33917# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ADDITIONAL OBSERVATIONS OF PLANETS AND QUASI-STELLAR RADIO SOURCES AT 3 MM
Eugene E. Epstein, Steven L. Soter, John P. Oliver, Kurt W. Riegel, and Ronald A. Schorn Los Angeles, Calif. SAMSO Mar. 1969 66 p refs
(Contract F04701-68-C-0200)
(AD-687438; TR-0200(9230-04)-1; SAMSO-TR-69-122) Avail: CFSTI CSCL 3/2

Contents: On the small-scale distribution at 3.4-mm wavelength of the reported 3 degree K background radiation; Mars, Jupiter, and Saturn: 3.4-mm brightness temperatures; The galactic radio source W 49 at 3.4 mm; Mercury: observations of the 3.4-mm radio emission; Quasars: 88-GHz flux measurements; Venus: on an inverse variation with phase in the 3.4-mm emission during 1965 through 1967; The galactic radio source DR 21 at 3.3 mm. TAB

N69-33952*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONTRIBUTIONS OF MAGNETIC FIELD RESEARCH TO SPACE SCIENCE
Alois W. Schardt *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 3-18 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 04A

Reviewed is the state-of-the-art in magnetic field research with emphasis on magnetic field measurements, primarily on the low field end, with .01 gamma accuracy. The design of a spacecraft to conduct such measurements is considered but reliability requirements for long range operation still remain a problem. Present propulsion techniques require at least two years to reach Jupiter and several times that much to go beyond 10 A.U. Magnetic field vector measurements by the moving satellite at one point in space, followed by a succession of point measurements, may be used to investigate the outer radiation belts and the tail of the magnetosphere. G.G.

N69-33984*# Nevada Univ., Reno.
AVERAGE INTERPLANETARY MAGNETIC FIELD FOR ANGULAR MOMENTUM CALCULATIONS
Jerry L. Modisette *In its* Space Magnetic Exploration and Technol. 1967 p 167–173 refs (See N69-33951 19-23)
Avail: CFSTI CSCL 04A

The average solar magnetic field can be determined from direct measurements based on observations of Zeeman splitting of lines in the solar spectra, and by inferred data obtained from extrapolating the field measured in interplanetary space. Satellite measurements of the interplanetary magnetic field show the corresponding solar field, obtained by interplanetary measurement back to the sun by an inverse square law, varying from one or two gauss at sunspot minimum to about five gauss at sunspot maximum. G.G.

N69-34019# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany). Institut für Extraterrestrische Physik.
SHORT DESCRIPTION OF THE RESEARCH PROGRAM OF THE MAX-PLANCK-INSTITUT FUER PHYSIK UND ASTROPHYSIK, INSTITUT FUER EXTRATERRESTRISCHE PHYSIK, GARCHING BEI MUENCHEN
Jul. 1967 4 p
Avail: CFSTI

Reviews the research projects at the Max-Planck-Institute of Extraterrestrial Physics, Garching describing barium cloud experiments, ionospheric electron density measurements, rocket sounding research of radiation belts and solar particles, studies of cosmic rays, gamma rays, neutrons, solar plasma experiments, UV-spectroscopy, and hyperfine structure measurements. ESRO

N69-34022# Aix-Marseilles Univ. (France).
STUDIES ON INTERPLANETARY SCATTERING [ETUDE SUR LA DIFFUSION INTERPLANETAIRE]
André-Jean Maucherat (Ph.D. Thesis) [1969] 83 p refs In FRENCH
Avail: CFSTI

Previous observations and photographies of the zodiacal light are reviewed and some recent experiments carried out in France to study light scattering by interplanetary dust are presented. The calibration of the measuring device and the results are discussed and a model of the interplanetary medium and a possible origin of the zodiacal light are proposed. Author (ESRO)

N69-34084# Osservatorio Astrofisico di Arcetri, Florence (Italy).
X-RAY FLUXES FROM THE SOLRAD 8 SATELLITE FROM DECEMBER 1965 TO NOVEMBER 1967
M. Landini, B. Fossi, D. Russo, and G. L. Tagliaferri Florence Univ. 18 Sep. 1968 28 p refs Sponsored by Ital. Comm. for Space Res. *Its* Osservazioni e Mem. Fascicolo 91
Avail: CFSTI

X-ray data in the 44-60, 8-20 and 0-8 Å bands have been recorded from Solar Radiation 8 satellite at Arcetri Observatory. Observations made during the period December 1965 to November 1967 are presented, the fluxes being measured in the three bands for 979 passes of the satellite. ESRO

N69-34098# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
SOLAR OPTICAL PATROL OBSERVATIONS
In its Geophys. and Space Data Bull., Vol. 5, No. 2 1968 p 33–84 (See N69-34094 19-13)
Avail: CFSTI

Solar Optical Patrol observation data are tabulated. The data include observation of chromospheric flares, flare film records, chromospheric activity other than flares, white light visual sunspot drawing, spectrographic coronal observations, and sunspot group analysis. M.W.H.

N69-34099# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
SOLAR RADIO EMISSION
In its Geophys. and Space Data Bull., Vol. 5, No. 2 1968 p 85–165 ref (See N69-34094 19-13)
Avail: CFSTI

Data are tabulated from solar radio emission observations. The tables include spectral burst observations, graphs of radio noise and solar flux, distinctive solar radio emission events, mean flux density, polarization measurements, and daily averages. The measurements were made at several locations around the world in April, May, and June 1968. M.W.H.

N69-34152# Osservatorio Astrofisico di Arcetri, Florence (Italy).
OBSERVATIONS OF SOLAR RADIO BURSTS FROM SEPTEMBER 1965 TO DECEMBER 1967
F. Drago Florence Univ. Feb. 1969 34 p *Its* Osservazioni e Mem. Fascicolo 90
Avail: CFSTI

Data are given on solar radio bursts recorded at Arcetri Observatory in the period September 1965 to December 1967 on frequencies of 1420 MHz and 9285 MHz. ESRO

N69-34157# Osservatorio Astrofisico di Arcetri, Florence (Italy).
MAPPING OF Ca II K SUNSPOTS DURING THE INTERNATIONAL QUIET SUN YEARS (IQSY) 1964–1965. PART 2: YEAR 1965 [MAPPE DEI FLOCCULI SOLARI IN RADIAZIONE K DEL Ca II PER GLI ANNI INTERNAZIONALI DI QUIETE SOLARE (IQSY) 1964–1965. SECONDA PARTE: ANNO 1965]
Giovanni Godoli Florence Univ. [1969] 200 p In ITALIAN; ENGLISH summary *Its* Osservazioni e Mem. Fascicolo 87
Avail: CFSTI

Ca II K sunspot maps for the second year of the IQSY are presented. Author (ESRO)

N69-34164# Osservatorio Astrofisico di Arcetri, Florence (Italy).
X-RAY FLUXES FROM THE SOLRAD 9 SATELLITE (1968-17A) FROM MARCH 1968 TO DECEMBER 1968
M. Landini, B. Fossi, G. Poletto, D. Russo, and G. L. Tagliaferri Florence Univ. Mar. 1969 18 p refs Sponsored by Ital. Comm. for Space Res. *Its* Osservazioni e Mem. Fascicolo 92
Avail: CFSTI

Data on X-rays in the 44-60, 8-16 and 1-8 Å bands have been recorded from Solar Radiation 8 satellite at Arcetri Observatory. Observations made during the period March to December 1968 are presented, the fluxes being measured in the three bands for 700 passes of the satellite. ESRO

N69-34166# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
RADIO FREQUENCY INTENSITY MODULATION OF STARLIGHT BY THE IONOSPHERE
Glen J. Morris May 1969 11 p refs
(DI-82-0857) Avail: CFSTI

Narrow band, radio frequency intensity modulated components have been detected in the light from several stars. The observations were made using a photomultiplier radiometer. Modulation

frequencies are in the range from 1 to 20 MHz, with the distribution peaking between 4 and 5 MHz. Modulation factors are of the order of 10^{-2}. Signal bandwidths typically are less than that of the receiver, namely 0.9 MHz. The effect appears to be general since such signals have been detected for all stars studied to date. The signals appear to originate in the ionosphere. Author

N69-34367# Army Foreign Science and Technology Center, Washington, D.C.
CELESTIAL BALLISTICS
V. I. Levantovskii May 1969 118 p refs Transl. into ENGLISH of an unidentified Russian Report
(AD-688525; FSTC-HT-23-563-68) Avail: CFSTI CSCL 22/3

The book discusses the basic science concerned with the motion of artificial celestial bodies -- earth satellites, automatic interplanetary stations and manned spaceships. From this work, the reader will learn how scientists intend to reach the stars and what considerations guide them in planning flights of space vehicles and expeditions to the moon and planets. The methods of types of flight trajectories of cosmonauts, both today and tomorrow, the methods of guiding and controlling the motions of space vehicles, and the different maneuvers in circumearth, circumlunar and interplanetary space are discussed. The reader will learn not only of the successes of stellar ballistics but also of the colossal difficulties which scientists and engineers must overcome and of the problems which have not yet been solved and which will be of real concern to tomorrows scientists. Author (TAB)

N69-34478# Stanford Univ., Calif. Inst. for Plasma Research.
STUDIES OF THE PHYSICAL PROPERTIES OF QUASI-STELLAR OBJECTS Interim Report
P. A. Feldman Mar. 1969 86 p refs
(Contract N00014-67-A-0112-0006)
(AD-687693; SU-IPR-285) Avail: CFSTI CSCL 3/2

The work deals with quasi-stellar objects as cosmologically distant entities, in accord with the currently accepted interpretation of their redshifts. It has been attempted to understand the physical properties of these objects within the basic framework of the galactic-flare model of Sturrock, which was originally developed in connection with a theory for the major explosions associated with quasars and radio galaxies. The primary aim of the work has been to explain the enormous luminosities, especially in the infrared, that must be produced by cosmologically distant quasars (and certain active galaxies). The resultant explanation turns out to be successful not only in this respect but also in leading to a satisfactory model encompassing a number of other aspects of the quasar phenomenon. A specific model for the quasar archetype 3C 273B is discussed quantitatively. It is shown that the physical characteristics of the line-emission region and of the meter-wave radio region are consistent with those adopted for the source of strong infrared continuum radiation. Suggestions are made for possible observations that could help to verify the proposed model. Author (TAB)

N69-34529# European Space Research Organization, Paris (France).
ENVIRONMENTS AND THEIR ROLE IN SPACECRAFT TECHNOLOGY. VOLUME 1: ACCELERATION, WEIGHTLESSNESS, AND VACUUM EFFECTS.
Jan. 1969 180 p refs In ENGLISH and FRENCH Proc. of the 6th ESRO Summer School, Noordwijk, Neth., 1968
(ESRO-SP-40) Avail: CFSTI

CONTENTS:

1. THE SPACE ENVIRONMENT: A SURVEY H. Martinides p 7–35 refs (See N69-34530 19-30)

2. ENVIRONMENTAL ASPECTS OF SPACECRAFT DESIGN, DEVELOPMENT AND OPERATION: A SURVEY R. Somoza p 37–65 (See N69-34531 19-31)

3. SHOCKS AND VIBRATIONS, PART 1 G. Barteud p 67–96 refs (See N69-34532 19-31)

4. THE ACCELERATION ENVIRONMENT OF A SPACECRAFT AND ITS SIMULATION IN THE LABORATORY: SHOCK AND VIBRATION, PART 2 W. H. Johnson p 97–118 (See N69-34533 19-31)

5. WEIGHTLESSNESS R. C. Meiner p 119–136 refs (See N69-34534 19-30)

6. EFFECTS OF VACUUM ON MATERIALS Henry E. Frankel (NASA, Goddard Space Flight Center) p 137–161 refs (See N69-34535 19-30)

N69-34530# European Space Technology Center, Noordwijk (Netherlands).
THE SPACE ENVIRONMENT: A SURVEY
H. Martinides *In* ESRO Environ. and their Role in Spacecraft Technol., Vol. 1 Jan. 1969 p 7–35 refs (See N69-34529 19-30)
Avail: CFSTI

Various features of the environment encountered by Earth-orbiting satellites are surveyed in relation to their possible influence on satellite design. In particular, the following components of that environment are discussed: acceleration, vibration and shocks, weightlessness, gas pressure, electromagnetic radiation, micrometeorite fluxes, and magnetic fields. The origin of these phenomena and the problems associated with them are described. Where possible, typical numerical values are given for a quantitative description of certain environmental features. Author (ESRO)

N69-34534# European Space Technology Center, Noordwijk (Netherlands).
WEIGHTLESSNESS
R. C. Meiner *In* ESRO Environ. and their Role in Spacecraft Technol. Vol. 1: Jan. 1969 p 119–136 refs (See N69-34529 19-30)
Avail: CFSTI

The paper presents a survey of the current status of 'zero-g' research. The emphasis is placed on describing some important physical and biological phenomena occurring under weightless conditions as well as some common methods of simulating 'zero-g' conditions for experimental study. Author (ESRO)

N69-34535# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF VACUUM ON MATERIALS
Henry E. Frankel *In* ESRO Environ. and their Role in Spacecraft Technol., Vol. 1: Jan. 1969 p 137–161 refs (See N69-34529 19-30)
Avail: CFSTI

The selection of materials for use in space environments requires knowledge of these unusual parameters and of the effects they have on materials. Most of all the parameters of the space environment are the same as those of terrestrial environments, except that the former are generally more severe. However, in space a new condition is imposed--vacuum. The degradative effects of this alien condition on metals, alloys, lubricants, ceramics, coatings, thin films, and polymeric systems are discussed. In some instances, a vacuum environment can be extremely beneficial to systems so

that a component can be designed to take advantage of the environment. Methods of prevention of premature failure in a space environment as well as proper testing are also presented. Author (ESRO)

N69-34837*# Boeing Co., Seattle, Wash. Aerospace Systems Div.
CHEBYCHEV TRAJECTORY OPTIMIZATION PROGRAM (CHEBYTOP) Final Report
D. W. Hahn, F. T. Johnson, and B. F. Itzen Jul. 1969 96 p refs
(Contract NAS2-5185)
(NASA-CR-73359; D2-121308)1) Avail: CFSTI CSCL 22C

A digital computer program called the Chebychev Trajectory Optimization Program (ICHEBYTOP) is described. The purpose of CHEBYTOP is to provide an analysis tool that will enable the user to rapidly conduct the optimization and parametric analysis of interplanetary missions employing electrically propelled spacecraft. A new analytical and numerical optimization algorithm, called the Chebychev Optimization Method, is used. The resulting computer program operates with greater speed and reliability than other existing methods of comparable accuracy and versatility. In some cases the operating speed is more than a factor of ten faster than conventional methods. CHEBYTOP will compute either variable thrust or constrained thrust, multiple coast trajectories. Variable thrust answers are computed by the Chebychev Optimization Method. Thrust limited results are obtained by a prediction scheme which uses the variable thrust answer as a basis for approximating multiple coast results. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-33263*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
30 Apr. 1969 221 p refs
(Contract NAS7-100)
(NASA-CR-103772; JPL-SPS-37-56-Vol-3) Copyright. Avail: CFSTI CSCL 22B

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4. TELECOMMUNICATIONS DIVISION p 78–118 refs (See N69-33267 19-07)
5. GUIDANCE AND CONTROL DIVISION p 119–148 refs (See N69-33268 19-03)
6. ENGINEERING MECHANICS DIVISION p 149–170 (See N69-33269 19-17)
7. ENVIRONMENTAL SCIENCE DIVISION p 171–175 (See N69-33270 19-03)
8. PROPULSION DIVISION p 176–212 refs (See N69-33271 19-27)
9. ADVANCED STUDIES p 213–216

N69-33265*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYSTEMS DIVISION
In its Supporting Res. and Advanced Develop. 30 Apr. 1969 p 8–41 refs (See N69-33263 19-31)
Copyright. Avail: CFSTI CSCL 22B

A first order perturbation theory is used to find a solution for the problem of relativistic perturbations of osculating orbital parameters of a spacecraft moving in the gravitational field of the sun. The variation of parameters method is applied to the three different line elements: (1) Robertson's general spherically symmetric static metric; (2) isotopic metric; and (3) Schwartzschild's metric. Conjugate points in an optimization problem are analyzed for a dynamic programming solution. A program for the computation of first order general perturbations is expanded to include successive approximations and series expansions to obtain higher order perturbations. Periodic terms in general relativity perturbations are computed by analyzing radar signal reflection data. The approximation of a minimum mean square estimator for parameters of probability distributions is described, and the effects of the asteroid belt on the Mariner Mars celestial mechanics experiment are analized. Other studies pertain to polynomial expansions of Einstein functions, computation of Debye functions of integer orders, and approximate solutions to rank deficient linear least squares problems. G.G.

N69-33278*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NONGRAVITATIONAL FORCES
R. D. Bourke, S. R. Mc Reynolds, and K. L. Thuleen *In its* The Mariner 5 Flight Path and Its Determination from Tracking Data 1 Jul. 1969 p 27–30 (See N69-33276 19-30)
Avail: CFSTI CSCL 22B

The nongravitational forces on Mariner 5 spacecraft in flight were studied through their effects on attitude motion. Solar radiation pressure, and attitude control thrust were found to be the significant forces; however, it is concluded that attitude control system forces had a negligible effect on the trajectory. F.O.S.

N69-33289*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH ACHIEVEMENTS REVIEW. VOLUME 3: AEROPHYSICS RESEARCH AT MSFC
1968 133 p refs
(NASA-TM-X-53799; Rept-4) Avail: CFSTI CSCL 22B

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1. ROCKETS AT LARGE ANGLES OF ATTACK C. D. Andrews, J. F. Weaver, J. D. Warmbrod, and H. G. Struck p 1–10 refs (See N69-33290 19-31)
2. LUDWIEG TUBE PILOT TEST AND HIGH REYNOLDS NUMBER TEST EQUIPMENT J. W. Davis p 11–16 refs (See N69-33291 19-01)
3. THEORETICAL ANALYSIS OF THE STARTING PROCESS IN THE LUDWIEG TUBE J. D. Warmbrod and H. G. Struck p 17–24 refs (See N69-33292 19-12)
4. FLOW CHARACTERISTICS OF ORIFICES FOR VENTING LAUNCH VEHICLE COMPARTMENTS P. E. Ramsey p 25–34 refs (See N69-33293 19-31)
5. PLUME FLOW FIELD ANALYSIS FOR LIQUID PROPELLANT ROCKET ENGINES J. L. Sims and T. Greenwood p 35–50 refs (See N69-33294 19-28)
6. TECHNIQUES DEVELOPED TO DETERMINE AERODYNAMIC COEFFICIENTS FOR APOLLO APPLICATIONS PROGRAM VEHICLES IN AN ORBITAL ENVIRONMENT J. D. Johnson p 51–60 refs (See N69-33295 19-31)
7. ACQUISITION AND REDUCTION OF LARGE VOLUMES OF FLUCTUATING DATA L. A. Schutzenhofer and P. W. Howard p 61–70 refs (See N69-33296 19-31)

8. PERCEIVED SOUND J. H. Jones p 71-80 refs (See N69-33297 19-23)

9. RADIATIVE HEAT TRANSFER FROM SATURN EXHAUST PLUMES R. M. Huffaker p 81-90 refs (See N96-33298 19-33)

10. DEVELOPMENT OF LASER-DOPPLER GAS VELOCITY INSTRUMENTATION R. M. Huffaker p 91-98 refs (See N69-33299 19-16)

11. OPTICAL CROSS-BEAM INVESTIGATION OF LOCAL SOUND GENERATION IN JETS F. R. Krause p 99/110 refs (See N69-33300 19-23)

N69-33290*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ROCKETS AT LARGE ANGLES OF ATTACK

Clayton D. Andrews, James F. Weaver, John D. Warmbrod, and Heinz G. Struck *In its* Res. Achievements Rev., Vol. 3 1968 p 1-10 refs (See N69-33289 19-31)

Avail: CFSTI CSCL 22B

Currently available experimental and theoretical results are compared for simple bodies of revolution. The modified two-dimensional theoretical results compare favorably, trendwise, with the experimental data. Suggestions are made for improving the modified two-dimensional theory, based on wake flow studies about delta wings at high angles of attack. The combined experimental and theoretical program to better define high angle of attack rocket loadings is approximately 50 percent complete. It is felt that the end product design tool will be an empirical-theoretical approximation that can be made with a high degree of confidence. Author

N69-33293*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

FLOW CHARACTERISTICS OF ORIFICES FOR VENTING LAUNCH VEHICLE COMPARTMENTS

P. E. Ramsey *In its* Res. Achievements Rev., Vol. 3 1968 p 25-34 refs (See N69-33289 19-31)

Avail: CFSTI CSCL 22B

A digital computer program was developed to predict internal pressures during flight. However, because of the lack of knowledge concerning the vent discharge flow coefficients, this program is an approximate solution. Since available experimental data were limited to ratios of jet-to-external stream mass flow greater than 0.15 and negligible external-flow boundary layers, an experimental study was undertaken in a 1.8 by 1.8-m supersonic wind tunnel. In general, the flow coefficients were nearly the same for circular, square, rectangular, and elliptical vents, with the long axis 90 degrees to the flow. The efficiency of the larger slots oriented 90 degrees to the flow agreed with the other vent data, but very thin slots were more efficient than all other vents. When the major axes of the vents were aligned with the external flow, substantial gains in efficiency were realized. Also, vent efficiencies increased with increased boundary layer thickness. Mach number effects were small for all vents in the subsonic and transonic regions, but became significant for supersonic Mach numbers. Efficiencies of the very narrow slots were not affected by changes in Mach number. Author

N69-33295*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

TECHNIQUES DEVELOPED TO DETERMINE AERODYNAMIC COEFFICIENTS FOR APOLLO APPLICATIONS PROGRAM VEHICLES IN AN ORBITAL ENVIRONMENT

Josh D. Johnson *In its* Res. Achievements Rev., Vol. 3 1968 p 51-60 refs (See N69-33289 19-31)

Avail: CFSTI CSCL 22B

Two methods developed to determine the aerodynamic forces acting on artificial earth satellites with complex external shapes are described. One method, a numerical solution based on well-established free molecule flow theory, has the capability to determine areas on a vehicle that are shaded from the flow. This method, which is applicable for speed ratios equal to or greater than two, requires large amounts of computer time. The second method is an approximation technique that uses the projected frontal area as a basis for computing aerodynamic forces. It is applicable for speed ratios greater than seven, particularly when large amounts of data are required for several similar configuration geometries. Author

N69-33296*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ACQUISITION AND REDUCTION OF LARGE VOLUMES OF FLUCTUATING DATA

Luke A. Schutzenhofer and Paul W. Howard *In its* Res. Achievements Rev., Vol. 3 1968 p 61-70 refs (See N69-33289 19-31)

Avail: CFSTI CSCL 22B

An experimental program in which large volumes of random (in space and time) data were generated is described. Some of the details of the overall requirements, the data acquisition system, amplitude and phase calibration techniques, static and dynamic operating characteristics of the data acquisition system, component qualification testing, model vibration testing, and the data reduction technique are also included. Author

N69-33386*# Israel Program for Scientific Translations, Ltd., Jerusalem.

EXTRA WEIGHT REQUIRED FOR TRAJECTORY CORRECTION

In its Mech. of Spaceflight Low-Thrust 1969 403-410 (See N69-33354 19-28)

Avail: CFSTI CSCL 22C

The question is considered of assessing the fuel requirements for a trajectory correction, as applied to an ideal power-limited engine. For this the problem reduces to determining the minimum mathematical expectation of the increment in the integral of the square of the thrust acceleration. Errors in the execution of the optimum thrust-acceleration program, errors in the measurements of the coordinates and velocities, and deviations from the initial conditions are taken into account. The probability characteristics of these random variables (the mathematical expectation, the correlation function, and the dispersion) are considered as known. Restrictions are imposed on the dispersion of the final deviations of the coordinates and velocities. The vehicle trajectory is corrected by successive discrete corrections of the thrust program of the continuously-operating main engine; these are based on measurements taken at specific instances of time (the correction point). The optimum distribution and optimum number of corrections points are selected from the condition of minimum mathematical expectation of the increment in the problem functional. An extensive bibliography on the general subject of trajectory correction is appended. K.R.G.

N69-33387*# Israel Program for Scientific Translations, Ltd., Jerusalem.

ANALYTIC SOLUTIONS OF THE EQUATIONS OF DYNAMICS

In its Mech. of Spaceflight Low-Thrust 1969 p 411-433 (See N69-33354 19-28)

Avail: CFSTI CSCL 22C

Equations of dynamics are written for two-dimensional or three-dimensional motion in a central field. The differential equation

are hence simplified, but not sufficiently so to yield explicit expressions for the optimum control functions and trajectories. To achieve this aim, control functions are considered which are nonoptimum but enable the obtaining of exact or approximate formulas which govern the motion. Each such solution represents an elementary space maneuver, where the specified maneuver is split into elementary ones. Complex maneuvers are split into the following elementary ones: escape in a central gravitational field from a circular initial orbit; the inverse maneuver, i.e., capture of the vehicle by the gravitational field into a circular orbit; transfer between circular coplanar orbits; rotation of the orbital plane; altering the satellite position in the orbit; and changing the orbit elements (major semiaxis, eccentricity, inclination, apogee and perigee radii, and focal parameter). K.R.G.

N69-33380*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TRANSONIC AERODYNAMIC CHARACTERISTICS OF A SATURN IB MANNED ORBITING RESEARCH LABORATORY LAUNCH VEHICLE

Stuart G. Flechner and Richard A. Langhans Washington Aug. 1969 44 p refs

(NASA-TM-X-1848) Avail: CFSTI CSCL 22B

A wind-tunnel investigation was conducted at Mach numbers from 0.40 to 1.20, angles of attack from -6° to 20°, and model roll angles of 0°, 45°, and 90° to determine the transonic aerodynamic characteristics of the Saturn 1B launch vehicle with a proposed manned orbiting research laboratory (MORL). The model was tested with natural and fixed boundary-layer transition, and with and without four thrust-augmentation rockets attached to the booster. Author

N69-33417*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RTG INTERFACE SPECIFICATIONS: NASA EVALUATION WITH MODELS OF OPTIMIZED NUCLEAR SPACECRAFT (NEW MOONS), TASK 6

William S. West, Herbert W. Bilsky (RCA, Princeton, N.J.) and Andrew J. Parker, Jr. (Hittman Associates, Inc., Columbia, Md.) Apr. 1969 65 p refs Prepared for NASA by RCA, Princeton, N.J.

(Contract NAS5-10441)

(NASA-TM-X-63617; X-701-79-179) Avail: CFSTI CSCL 22B

This report covers NEW MOONS, RTG interface specifications and presents an illustrative specification containing typical criteria that may be encountered on scientific missions into deep space. These materials could be used as a guide in the preparation of an actual interface specification for RTG hardware. Author

N69-33419*# TRW Systems Group, Redondo Beach, Calif.

PIONEER 6 ORIENTATION CONTROL SYSTEM DESIGN SURVEY: NASA/ERC DESIGN CRITERIA PROGRAM, GUIDANCE AND CONTROL

W. A. Massey 25 Sept. 1968 30 p refs Revised

(Contract NAS12-110)

(NASA-CR-86193; TRW-06314-6006-R0-01-Rev-1) Avail: CFSTI CSCL 22B

The Pioneer 6 control system equipment was relatively unsophisticated, except for the sun detector. The functional performance of the orientation control system met or exceeded the specified requirements with a few minor exceptions. The historical evolution of the control system equipment from the first feasibility studies until the completion of the design phase of the program are described. The sun sensors were the most difficult assembly of the orientation control system. Sun sensor problems included fabrication and testing difficulties, thermal compensation problems, component procurement and reordering problems, and an unexpectedly short life in orbit due to extreme sensitivity to radiation. It is believed that the chief single cause of these problems was the use of a new and relatively unknown device for the sensor detectors. The use of proven hardware for every component was a severe design constraint, and the use of some new devices was unavoidable. Nevertheless, the experience on Pioneer supports the well-known principle that the use of proven components reduces risks and problems. Author

N69-33606*# Illinois Univ., Urbana. Engineering Experiment Station.

TRANSIENT THERMAL MODELING WITH SIMULATED SOLAR RADIATION Final Report

B. T. Chao and M. N. Huang Mar. 1969 50 p refs Prepared for JPL

(Contracts NAS7-100; JPL-951660)

(NASA-CR-103852; ME-TR-JPL-951660-2) Avail: CFSTI CSCL 22B

The feasibility of artificially modifying the thermal conductance of metal plates or sheets by electroplating is investigated in order to satisfy the transient modeling requirements of systems involving more than on material. A one-quarter scale model of two rectangular plates of different materials was fabricated and tested for both steady and transient heat flow conditions. For solar simulation, a 12-inch diameter fused silica window was designed, fabricated, and installed on the space simulation chamber. It consists of a radiation source produced by a carbon arc inside a lamphouse, an optical system, and a recitifier supplying dc to the carbon electrodes. The performance, test procedures, and test results are presented. Tables and graphs summarizing the results are included. F.O.S.

N69-33700*# TRW Systems Group, Redondo Beach, Calif.

RADIO/OPTICAL/STRAPDOWN INERTIAL GUIDANCE STUDY FOR ADVANCED KICK STAGE APPLICATIONS: LAUNCH VEHICLE DATA, TASKS 5 AND 6

Apr. 1969 557 p

(Contract NAS12-141)

(NASA-CR-86199) Avail: CFSTI CSCL 22B

Launch vehicle data and data plots for the radio/optical/strapdown inertial guidance systems study are reported. The vehicle configurations considered were: Atlas SLV3C/Centaur, Atlas SLV3A/Burner 2, Saturn 1B/Centaur, and Saturn 5/Voyager. Data plots are included for: trajectory parameters, mass properties, aerodynamic parameters, bending data, and propellant slosh data. A drawing for each of the vehicle configurations is presented and the thrust control characteristics are included. Some of this data were extracted from previous study results. Bending mode computer plots are also furnished within this report. A summary of thrust control actuation system transfer functions, rate limits, and deflection limits are given at the end of the report. Author

N69-33796# California Univ., Livermore. Lawrence Radiation Lab.

SUMMARY OF LRL SOUNDING-ROCKET EXPERIMENTS FROM 1963 THROUGH 1968

Frederick D. Seward 12 Mar. 1969 13 p refs Sponsored by AEC

(UCRL-50587) Avail: CFSTI

Sounding-rocket experiments performed by the Lawrence Radiation Laboratory, Livermore, from 1963 through 1968 are summarized. The results of the flights are given in tabular and graphic form. Also listed are the kinds of rockets used, their motion in flight, the experiments carried, and the success or failure of each rocket and experiment. Author (NSA)

N69-33840# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF DYNAMIC UNBALANCE ON THE ACCURACY OF MEASUREMENT OF THE SUN'S INCIDENCE ON THE X3 SATELLITE
D. J. Gilson Nov. 1968 21 p refs
(RAE-TR-68278) Copyright. Avail: CFSTI

An analysis is made of the error in measurement of the angle of incidence of the sun on the Black Arrow X3 satellite due to displacement of the spin axis caused by dynamic unbalance. It is found that in order to satisfy the major requirements of the solar cell experiment, close control of dynamic unbalance is required, a maximum of 140 oz in^2 being suggested. Author (ESRO)

N69-33841*# Electro-Optical Systems, Inc., Pasadena, Calif. Aerospace Systems Div.
CONTACT ION ENGINE SYSTEM FOR ATS SATELLITES D AND E Annual Progress Report
R. M. Worlock 1 Jul. 1969 44 p refs
(Contract NAS5-10380)
(NASA-CR-103890; EOS-7202-A-2; APR-2) Avail: CFSTI CSCL 22B

A program to fabricate and test ion microthruster systems for Applications Technology Satellites D and E, provide appropriate ground support equipment, and provide technical support of spacecraft integration, launch, and operation is reported. Accordingly, support of ATS-D operations was continued, culminating in the successful operation of both microthruster systems in orbit. Flight hardware units for ATS-E were completed, acceptance tested, and delivered to the spacecraft contractor. Author

N69-33858*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEYOR PROJECT. PART 1: PROJECT DESCRIPTION AND PERFORMANCE, VOLUME 1 Final Report
1 Jul. 1969 482 p refs
(Contract NAS7-100)
(NASA-CR-103841; JPL-TR-32-1265) Copyright. Avail: CFSTI CSCL 22B

The Surveyor Project planned and conducted seven unmanned lunar missions. Each of the spacecraft was successfully launched with the then newly developed Atlas/Centaur vehicle which utilized for the first time a high specific impulse, liquid hydrogen/liquid oxygen fueled stage. Five of the spacecraft successfully soft-landed and returned a great quantity of engineering and scientific data on extensive postlanding operations, accomplishing all mission and project objectives. Four of the spacecraft soft landed at selected mare sites to provide data which were required to support the *Apollo* Program. The final spacecraft was successfully used for scientific investigation of a contrasting site in the rugged lunar highlands. *Surveyor* was a fully attitude stabilized spacecraft designed to receive and execute a wide variety of earth commands, as well as to perform certain automatic functions including the critical terminal descent and soft landing sequences. Significant new and advanced subsystems were developed and/or used in combination to enable *Surveyor* to execute the complex terminal phase of flight. Author

N69-33916# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES
Nov. 1968 23 p
(ROE-STS-83) Avail: CFSTI

Stopwatch observations made at stations connected with the Section during the month of 1968 November are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N69-33940# Northeastern Univ., Boston, Mass.
ATTITUDE DETERMINATION AND DATA TRANSMISSION SYSTEMS FOR SPACE VEHICLES Final Report, 1 Apr. 1965 - 30 Sep. 1968
J. Spencer Rochefort, Lawrence J. O'Connor, and Arthur Glazer
31 Oct. 1968 71 p refs
(Contract AF 19(628)-5140)
(AD-687500; AFCRL-69-0146) Avail: CFSTI CSCL 22/2

The contract effort can be grouped under programs concerned with orbiting vehicles, evaluation of commercial telemetry system components, and field support for certain sounding rockets and balloons. The orbital vehicle effort is concerned with telemetry systems, a tracking system, a data storage system, aspect instrumentation and determination, a solar power system and a radiometer control and calibration system. A tabulation is given of commercial airborne telemetry components tested and evaluated since detailed results are published in scientific reports which are available to authorized agencies. The results of a UHF telemetry system test flight are discussed. The field support rendered in connection with the various programs is tabulated. Specific subroutine programs connected with aspect determination are included in appendices. Author (TAB)

N69-33965*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEMAGNETIZATION METHODS FOR SPACECRAFT SYSTEMS AND COMPONENTS
Charles A. Harris *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 174-188 (See N69-33951 19-23)
Avail: CFSTI CSCL 22B

Spacecraft demagnetization tests indicated the following: (1) demagnetization with a pulsing D.C. field is the least effective; (2) rotation of the object is desirable when an earth's field deperm is attempted; and (3) although the results tend to favor the D.C. rotation deperm over the 60 Hz A.C., effective demagnetization of spacecraft subassemblies could be achieved by either method. When eight IMP or OGO spacecraft assemblies were demagnetized by both methods the maximum and minimum percentages of effective deperm were as follows: A.C. = 99 and 46, D.C. rotation =99 and 46. In view of the favorable deperm results obtained with the D.C. rotation method and especially because of the advantages of such a system, i.e., variable frequency rates, reduction of eddy current and rise time effects, and elimination of circuit breaking, it is recommended that this method be utilized in the demagnetization of spacecraft. Generation of non-alternating D.C. field presents no difficulty and with the presently available Helmholtz coils and turntables, the D.C. rotation method could be employed in the demagnetization of the IMP or ISIS spacecraft in a facility such as the ACTF. Author

N69-33970*# General Dynamics/Convair, San Diego, Calif.
NEAR-EARTH MAGNETOMETER FLIGHTS WITH THE OVI SERIES SPACECRAFT
Kenneth O. Downing and Gordon D. Hall *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 258-270 (See N69-33951 19-23)
Avail: CFSTI CSCL 22B

Described is the performance of the OV1 spacecraft that uses a magnetometer to resolve roll position about the sun spacecraft vector for spatial orientation. The spacecraft consists of a right cylindrical section containing the experimental payload with the magnetometers mounted under the aft solar dome in three axis flux-gate units of ± 600 milligauss range. The effective spacecraft dipole moment is typically 400 to 700 pole-centimeters and the net field at the magnetometer varies according to the experimental payload flown. G.G.

N69-33973*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
MAGNETIC TESTS IN THE ATS-1 SPACECRAFT
L. L. Simmons *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 308–313 ref (See N69-33951 19-23)
(Contract NAS5-9570)
Avail: CFSTI CSCL 22B

The first Applications Technology Satellite was tested to determine its magnetic properties. The test methods and results are discussed. Author

N69-33976*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER VENUS 67 MAGNETIC CONTROL
J. G. Bastow *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 350–362 (See N69-33951 19-23)
(Contract NAS7-100)
Avail: CFSTI CSCL 22B

Magnetic control efforts on Mariner Venus 67 were limited to reducing and stabilizing the magnetic field of existing hardware and to obtaining more meaningful information on the magnetic condition of the hardware than had been obtained in the Mariner Mars 1964 program. All type approval (TA) hardware was magnetized and demagnetized and, if no adverse effects of demagnetization were observed, all flight hardware was demagnetized to erase the effects of environmental testing and to stabilize and reduce the magnetic field. Magnetic mapping data were processed by computer to provide the magnetic field components of the extrapolated field in spacecraft coordinates at the spacecraft magnetometer sensor. These field components were summed and compared with the mapped field of the complete spacecraft. Author

N69-33977*# TRW Systems, Redondo Beach, Calif. Space Sciences Lab.
MAGNETIC TESTS OF THE OGO AND ERS SATELLITES
G. T. Inouye *In* Nav. Univ. Space Magnetic Exploration and Technol. 1967 p 363–378 (See N69-33951 19-23)
(Contract NAS5-3900)
Avail: CFSTI CSCL 22B

This paper presents the results and methods used to test for the magnetic properties of the OGO and ERS satellites. The magnetic property of the spacecraft of paramount interest are the spacecraft magnetic field at the position of the on-board magnetic sensor, both permanent and induced. Also of interest is the proportion of this field which is "hard" or permanent, and the proportion which is 'soft' which may be changed by normal magnetizing environments to which the spacecraft may be subjected before being launched into orbit. Another magnetic property of interest is an overall map of the spacecraft field, and its characterization in terms of dipole and higher order multipoles, both permanent and induced, located at the center of the spacecraft. The testing techniques used in both the coil and coil-less methods involve the rotation of the spacecraft about two axes relative to fixed tri-axial fluxgate sensors. The fluxgate sensor outputs are recorded on both a multichannel Sanborn chart recorder and an X-Y plotter. The X-Y plot permits an immediate scaling of the magnitude of the magnetic moment in the plane of rotation, as well as giving its orientation in spacecraft coordinates. Rotation of the spacecraft about another orthogonal axis provides data for obtaining the total moment vector. Author

N69-33982# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES
Dec. 1968 29 p
(ROE-STS-84) Avail: CFSTI

Stopwatch observations made at stations connected with the Section during the month of December 1968 are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N69-33992# Weapons Research Establishment, Adelaide (Australia).
THE ESTIMATION OF PITCH DAMPING DERIVATIVES OF MISSILE CONFIGURATIONS AT SUBSONIC SPEEDS
M. L. Robinson Jan. 1969 51 p refs
(WRE-TN-HSA-144) Avail: CFSTI

A method for computing pitch damping derivatives of typical missile configurations at subsonic speeds is presented. The method, in which a quasi-steady analysis is used, is restricted to small amplitude oscillations and a frequency parameter not exceeding about 0.05. The body damping is considered in two parts, namely a slender body term, and a nonlinear term which arises from flow separation in the cross flow plane. The tail damping contribution is calculated taking into account the downwash produced by the body vortices. Theoretical results were computed for two different bomb shapes, and reasonable agreement between theory and experiment was obtained. The validity of pitch damping results obtained using shaft-mounted models is discussed. Author

N69-34026# European Space Technology Center, Noordwijk (Netherlands).
A STUDY OF THE THERMAL BEHAVIOUR OF THE ESRO 1 SATELLITE. PART 3: RESULTS
O. Ullmann Paris ESRO Jan. 1968 73 p refs
(ESRO-TN-24-ESTEC) Avail: CFSTI

A 93-node thermal mathematical model of the ESRO 1 satellite was developed at ESTEC during 1966–67. The description of the model and an account of its verification in a solar simulation chamber are given in ESRO-TN-20 and 21 (ESTEC). The present paper deals with the computations carried out to predict orbital spacecraft temperatures under various conditions. The thermal effects of the following are investigated: different orbit modes, slow rotation and oscillation about the longitudinal axis of the satellite, orbital inclination greater than 90° and a coating of white paint on part of the cylindrical panels. The results for the various cases are presented in tables, and are discussed at some length. Author (ESRO)

N69-34177# Royal Aircraft Establishment, Farnborough (England).
A THEORETICAL STUDY OF THE MULTISPRING STAGE SEPARATION SYSTEM OF THE BLACK ARROW SATELLITE LAUNCHER
A. P. Waterfall Aug. 1968 34 p refs
(RAE-TR-68206) Copyright. Avail: CFSTI

A mathematical model has been developed of a multispring system for the separation of spinning and non-spinning bodies and programmed for a digital computer. This has been applied to the particular study of the second-third stage and third stage satellite separation system of Black Arrow to ascertain how various malfunctions and manufacturing tolerances can affect the tip-off errors. It is shown that strong short stroke unguided springs transmit the smallest tip-off errors. Use of spring guides can only correct the intrinsic instability of springs; if this instability is only present to a negligible degree, guides can actually increase the tip-off errors. It is concluded that guides are necessary for third stage separation on Black Arrow but not for satellite separation. Author (ESRO)

N69-34278# International Business Machines Corp., Cambridge, Mass. Advanced Space Systems Dept.
OGO DATA PROCESSING PROGRAMS
William B. Wright and Edward V.Rutkowski May 1969 181 p refs
(Contract F19628-68-C-0252)
(AD-687752; AFCRL-69-0156; SR-1) Avail: CFSTI CSCL 22/2

The report presents a detailed description of the computer programs written to reduce telemetry data from OGO-A, EXPERIMENT 49-12 and OGO-C and OGO-D, EXPERIMENT 50-20. Included are techniques for handling data from digitized data tapes, presentation of this data in graphic form, and retrieving spacecraft information for particular areas of interest. A presentation of the technical aspects of OGO-F, EXPERIMENT 09 and a short description of the computer program that will interpret its data is provided. The report is composed of two major areas; technical aspects and problem descriptions. Author (TAB)

N69-34311*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION AND PRELIMINARY RESULTS OF THE SINGLE AXIS MOTION TESTS CONDUCTED ON THE NIMBUS-D ATTITUDE CONTROL SUBSYSTEM
Patrick H. Cudmore Jul. 1969 30 p refs
(NASA-TM-X-63626; X-731-69-307) Avail: CFSTI CSCL 01C

The engineering model Nimbus-D attitude control system (ACS) was mounted on a single axis table about each of its control axes in turn. The table was supported by a torsion wire whose top end was restrained. For each axis, table rate and position errors were physically introduced and then the ACS was activated. These tests demonstrated that the ACS: (1) was properly phased, (2) exhibited positive damping, and (3) was able to transition from acquisition to fine control smoothly. Author

N69-34531# European Space Technology Center, Noordwijk (Netherlands).
ENVIRONMENTAL ASPECTS OF SPACECRAFT DESIGN, DEVELOPMENT AND OPERATION: A SURVEY
R. Somoza *In* ESRO Environ. and their Role in Spacecraft Technol., Vol. 1: Jan. 1969 p 37-65 (See N69-34529 19-30)
Avail: CFSTI

The various environmental conditions affecting spacecraft design, including the artificial environment created by the spacecraft itself, are reviewed. Illustrative examples are provided from a particular spacecraft design, which has been chosen for the purpose because of its complexity. Other designs are mentioned only briefly. Author (ESRO)

N69-34532# European Space Technology Center, Noordwijk (Netherlands).
SHOCKS AND VIBRATIONS, PART 1 [CHOCS ET VIBRATIONS, PREMIERE PARTIE]
G. Bertaud *In* ESRO Environ. and their Role in Spacecraft Technol., Vol. 1: Jan. 1969 p 67-96 refs In FRENCH (See N69-34529 19-30)
Avail: CFSTI

This report is limited to a general survey of the mechanical causes that might damage satellites up to the time of their launching. The first part is devoted to environments encountered during transport which are sometimes incorrectly assumed to be of only second importance. The second part deals with conditions encountered during the launching of satellites when they are no longer protected by containers, this phase being a most dangerous one. ESRO

N69-34533# European Space Technology Center, Noordwijk (Netherlands).
THE ACCELERATION ENVIRONMENT OF A SPACECRAFT AND ITS SIMULATION IN THE LABORATORY: SHOCK AND VIBRATION, PART 2
W. H. Johnson *In* ESRO Environ. and their Role in Spacecraft Technol. Vol. 1 Jan. 1969 p 97-118 (See N69-34529 19-30)
Avail: CFSTI

Laboratory acceleration testing does not in general consist of imitating the real environment. The latter is often statistically variable. Such tests would have no safety margin and little development value. Steady acceleration testing is done by either centrifuge or rocket track vehicle. The rotating nature of the centrifuge produces problems of coriolis forces, acceleration gradient along the arm, and tangential accelerations if a rapid acceleration build-up is required. Shock is a form of vibration, but is transient and typically has very short acceleration build-up time and very high peak value. Shock test machines normally use standard pulses (e.g. half-sine, sawtooth, rectangular, etc.) produced by methods ranging from passive arresting materials (e.g. lead) to complex spring/dashpot/compressed gas devices. Vibration during launch is one of the most important of the environments. Mechanical vibrators do not permit waveform control, therefore hydraulic (for thrusts up to hundreds of tons) or electrodynamic are used. These are force-producing, and other forces fed-back from the test specimen necessitate *g*-controllers. The control equipment is particularly complicated for random vibration. Fixtures between vibrator and test specimen should have high natural frequencies, and test materials therefore have high values of the ratio modulus of elasticity/specific gravity. Many channels of acceleration measurement are often required during vibration test. Piezoelectric accelerometers and FM magnetic tape recording are almost universal. Author (ESRO)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-33232*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGN TECHNIQUES FOR SMALL SCIENTIFIC SATELLITE STRUCTURES
J. M. Madey and R. C. Baumann Washington Jul. 1969 108 p refs
(NASA-TN-D-4988) Avail: CFSTI CSCL 22B

A description of the design, development, integration, and testing of small scientific satellite structures in sufficient detail to serve as a design guide for the apprentice designer. It describes the many considerations and procedures involved from the initial concept phase through launch and post-flight analysis. To relate the general considerations and procedures to actual programs, data in the form of illustrations, specifications, checkoff lists, and other reference documents are provided for specific satellites. Author

N69-33388# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
GRAMPA: AN AUTOMATIC TECHNIQUE FOR EXCITING THE PRINCIPAL MODES OF VIBRATION OF COMPLEX STRUCTURES

F. J. Hawkins 1969 30 p refs Supersedes RAE-TR-65142; ARC-27369
(ARC-R/M-3588; RAE-TR-65142; ARC-27369) Copyright. Avail: CFSTI; HMSO 13s

This report describes a new technique for finding automatically, when using multipoint excitation, the force distribution required to produce in-phase responses at the excitation points on a structure. It is shown how this technique is used to find natural frequencies and principal mode shapes. The construction of a five-channel, servo-controlled system, circuit details and operation are explained in detail. Author (ESRO)

N69-33420*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYTICAL EVALUATION OF THE DENTING OF AIRPLANE SURFACES BY HAIL
Robert G. Thomson and Robert J. Hayduk Washington Aug. 1969 35 p refs
(NASA-TN-D-5363) Avail: CFSTI CSCL 20K

Hailstone damage to aircraft is exhibited as denting or complete penetration. An analytical evaluation of such denting characteristics of aircraft surfaces is idealized by having a crushable spherical projectile impact normal to a flat plate. Separate elastic and rigid-plastic analyses have been developed previously by using the classical thin-plate bending approach. As applied in this paper, the elastic analysis determines the area of the sheet around the center of impact, which has become plastic. The rigid-plastic analysis applied to this central plastic region determines the resulting permanent deformation (dent). Numerical results are presented in detail for the permanent deformations of two specific sheet thicknesses. Author

N69-33481*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF IMPROVED THROAT INSERTS FOR ABLATIVE ROCKET ENGINES
Jerry M. Winter and Donald A. Peterson Washington Jul. 1969 166 p refs Film Supplement Number C-261 to this report is available on loan from NASA, Lewis Research Center, Cleveland, Ohio
(NASA-TN-D-4964) Avail: CFSTI CSCL 20K

Seventy-five throat inserts and nine complete nozzle designs were evaluated in a storable propellant (nitrogen tetroxide and a 50-percent blend of unsymmetrical dimethyl hydrazine with hydrazine) rocket engine. An insert of iridium-rhenium on a tungsten substrate ran successfully until gas diffusion through the porous iridium caused substrate oxidation. Composites of hypereutectic carbides; anion deficient zirconium oxide; mixed oxides of hafnium, titanium, and zirconium; wire reinforced zirconium oxide; and a refractory macrolaminate were all run through a varied and extended duty cycle. Rocket-engine testing, in the combustion environment of interest, for the intended duty cycle, was the most efficient method of advanced material evaluation. A motion-picture film supplement is available on request. Author

N69-33739# Technische Hochschule Munchen (West Germany).
EXPERIMENTAL AND THEORETICAL STUDIES OF THE FORCES AND MOTIONS IN THE CONTACT AREA OF FREE-ROLLING TIRES [EXPERIMENTELLE UND THEORETISCHE UNTERSUCHUNGEN DER IN DER AUFSTANDSFLAECHE FRIE ROLLENDER REIFEN WIRKENDEN KRAEFTE UND BEWEGUNGEN]
Norbert Seitz (Ph.D. Thesis) 1969 193 p refs In GERMAN
Avail: CFSTI

Measuring and control instrumentation and a drum test stand were specially developed for determining the pressures, thrusts, and motions on the tire. The tests were conducted with one tire size, 5.90-13, at circumferential speeds of 120 km/h. The effects of type of tire, tire geometry, structural irregularities, material properties, and all physical test conditions were considered. The theoretical study consists of model analyses of the tire as an elastically embedded bar and as an elastic system of girders. Pressure distributions were calculated both with and without consideration of inner shear forces and outer horizontal forces. An abundance of photographs, drawings, and diagrams is included showing the test facilities, and instrumentation as well as the effective forces and motions on the tire. Transl. by K.W.

N69-33743# Technische Hochschule Munchen (West Germany).
A METHOD FOR THE MATHEMATICAL DETERMINATION OF SELF-OSCILLATION MAGNITUDES FROM THE RESULTS OF A VIBRATION EXPERIMENT IN AN EXCITER CONFIGURATION [EIN VERFAHREN ZUR RECHNERISCHEN ERMITTLUNG DER EIGENSCHWINGUNGSGROESSEN AUS DEN ERGEBNISSEN EINES SCHWINGUNGSVERSUCHES IN EINER ERREGERKONFIGURATION]
H. Guenther Natke (Ph.D. Thesis) 1968 103 p refs In GERMAN
Avail: CFSTI

A mathematical method is presented for determining natural frequencies, forms of self-oscillation, effect damping, and generalized masses of an undamped system part of an electromechanical system and the effective damping under the assumption of only one possible exciter configuration. The method is especially suited for examining self-oscillation characteristics in case of adjacent natural frequencies. A special case is solved which involves the effective damping at known natural frequencies and two degrees of freedom. The use of the method for more than two degrees of freedom is also discussed. The derivation of the correlation matrix and the mass matrix from the results of the static vibration test is demonstrated. A somewhat limiting factor in this method is that a large number of measuring points should be available and accessible. Transl. by K.W.

N69-33782# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
A STUDY OF THE EFFECTS OF COUPLING BETWEEN BENDING AND STRETCHING ON THE MECHANICAL BEHAVIOR OF LAYERED ANISOTROPIC COMPOSITE MATERIALS Technical Report, Jun. 1967–Jun. 1968
James M. Whitney Apr. 1969 93 p refs
(AD-687877; AFML-TR-68-330) Avail: CFSTI CSCL 13/13

Using the basic assumptions of thin plate theory the governing equations of a laminated anisotropic composite plate are formulated. In particular, the type of plate under discussion consists of n layers of orthotropic sheets (unidirectional composites) bonded together. Each layer has arbitrary thickness, elastic properties, and orientation of orthotropic axes with respect to the plate axes. The governing equations are obtained by integrating the equations of nonlinear elasticity over the plate thickness, inertia terms and thermal stresses are included. Author (TAB)

N69-33810# Royal Aircraft Establishment, Farnborough (England).
LOAD TRANSFER FROM BROKEN FIBRES IN COMPOSITE MATERIALS
I. Spilling and N. J. Wadsworth Sep. 1968 28 p refs
(RAE-TR-68237) Copyright. Avail: CFSTI

High modulus R.A.E. carbon fibers were placed in a resin matrix on an aluminium backing and strained. The behavior near breaks in the fibers was examined. If the interface was weak the broken fiber ends slid back in their holes in the resin and the load in the fiber was transferred by friction at the interface over a distance of about 1.2 mm. The mean frictional shear force was

about 6 MNm^{-2} (800 lbf in^{-2}). There was little interaction between adjacent fibres in small bundles and three-dimensional composites broke in a fibrous manner. If the interface was strong the load was transferred from broken fibers mainly elastically over a distance of about 130 μm. In bundles of a few fibers a crack in one spread to the others and three-dimensional composites broke in a brittle manner. Author (ESRO)

N69-33871# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.

STATIC TESTS ON UNSYMMETRICAL PLATE GIRDERS MAIN TEST SERIES

Wolfgang Schueller and Alexis Ostapenko Sept. 1968 105 p refs Sponsored jointly by Am. Iron and Steel Ind., Pa. Dept. of Highways, and the Welding Res. Council

(PB-183059; Rept-328.6) Avail: CFSTI CSCL 13M

Two unsymmetrical plate girders made of A36 steel were tested under statically applied loading. The primary objectives of the test were: verification of a new theory developed for the determination of the ultimate load of unsymmetrical plate girder (not described), and investigation of the behavior of the girder components under an increasing load. The layout and size of the girder elements were selected in such a way as to define the moment–shear interaction curve in the region of high moment and high shear. Only the end panels of the girder were subjected primarily to shear. Author (USGRDR)

N69-33994# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FRACTURE TOUGHNESS OF IRRADIATED AND UNIRRADIATED HEAVY SECTION PRESSURE VESSEL MATERIAL

T. T. Claudeson, J. A. Williams, and J. A. De Mastry 15 Jul. 1968 26 p refs Presented at Winter Ann. Meeting of the Am. Soc. of Mech. Engr., New York

(Contract AT(45-1)-1830)

(BNWL-SA-1992; CONF-681209-2) Avail: CFSTI

Fracture toughness characteristics of irradiated and unirradiated A533B are given. The plane strain fracture toughness, (K_{Ic}) for A533-B about 40 ksi$\sqrt{\text{in.}}$ at −160°C and increases to about 65 to 70 ksi $\sqrt{\text{in.}}$ as test temperatures increase to −80°C. Fracture arrest, (K_{Ia}) values show a similar temperature dependency and are about 6 to 7 ksi $\sqrt{\text{in.}}$ below the initiation values. The plane strain fracture toughness is elevated 25 to 30% at the surface of 12 in. A533-B quenched and tempered plate tested in these investigations. A validity criterion for testing low strength steels using the DCB specimen was determined. Initial results from fracture toughness determined on PM-2A agree with a value of K_{Ic} = 84,800 psi $\sqrt{\text{in.}}$ calculated from the failure conditions of the PM-2A vessel test. NSA

N69-34013# North Carolina State Univ., Raleigh.

OPTICAL DIFFRACTION TECHNIQUES FOR STRAIN MEASUREMENT

H. W. Blake, H. H. Stadelmaier, and R. A. Douglas Apr. 1969 36 p refs

(Contract N00014-68-A-0187; ARPA Order-1090)

(AD-687414; TR-69-4) Avail: CFSTI CSCL 20/11

New techniques are developed that extend the use of the diffraction grating strain gage to the measurement of axial strains when diffraction angle changes are large and that permit these integral gages to be used for measuring the circumferential strains produced by axial impact of cylindrical rods. Diffraction-strain equations are derived for several different optical configurations that may be employed in experimental studies. Photographs show typical diffraction patterns obtained for each configuration of laser, grating and film. Author (TAB)

N69-34136# Pennsylvania State Univ., University Park. Dept. of Engineering Mechanics.

SHOCK ANALYSIS OF STRUCTURAL SYSTEMS Interim Report, Mar. 1968 - Feb. 1969

Vernon H. Neubert, H. T. Hahn, C. Yang, and W. Vogel Feb. 1969 85 p refs

(Contract Nonr-656(28)(X))

(AD-687429; IR-8) Avail: CFSTI CSCL 20/11

Three separate reports are included. The first presents preliminary results of dynamic elastic-plastic bending tests of steel beams of rectangular cross-section. Based on measured accelerations and strains, curves of moment versus time, curvature versus time, and moment versus curvature are presented. The second report deals with predictions of the effect of local modification on the shock response of a spring mass system. A method is presented by which the modified system is solved in terms of the known modes of the original system. An example problem is solved involving a three-mass system. The third report deals with structural synthesis using normal modes of sub-systems. A simple example is given in which a structure is synthesized by three different methods. Author (TAB)

N69-34208# General Electric Co., Philadelphia, Pa. Missile and Space Div.

THE NATURAL MODES AND FREQUENCIES OF A UNIFORM CURVED BEAM VIBRATING IN THE PLANE OF THE BEAM

Sam Silverberg 9 Jul. 1969 75 p refs

(DOC-69SD285) Avail: CFSTI

Equations of motion are derived for a uniform beam of constant curvature. A method of solution is detailed and some results demonstrated. It is shown that increasing the angle through which the beam curves initially tends to stiffen the beam. As the angle increases further, and the center of mass moves away from the line joining the end joints, the mode shape changes from that of a straight beam to that of a swaying arch. The importance of shear deflections is demonstrated. Author

N69-34328# California Univ., Livermore. Lawrence Radiation Lab.

FATIGUE BEHAVIOR OF A HIGH DENSITY GRAPHITE AND A GENERAL DESIGN CORRELATION

H. Leichter and E. Robinson 26 Aug. 1968 55 p refs Presented at the Am. Ceram. Soc. 71st Ann. Meeting and Exposition, Washington, 3-8 May 1969 Sponsored by AEC

(UCRL-71316; CONF-690512-1) Avail: CFSTI

The fatigue behavior of a high-density graphite was investigated in reverse bending up to 5 × 10^8 cycles at room temperature. A statistical analysis was made of fatigue life, using a Weibull distribution and a homologous stress. The homologous stress is the ratio of applied stress in fatigue to the expected first-cycle strength. The first-cycle strength was calculated from the bending tests of similar material or mate specimens, using the Weibull statistical strength theory for correction of the significant size effect. Homologous stress gives an essentially invariant fatigue correlation for many graphite grades and may be used for the estimation of fatigue life under a wide variety of operating conditions. The practical endurance limit for graphite was found to correspond to a homologous stress of about 47%. Author (NSA)

N69-34229# United Kingdom Atomic Energy Authority, Risely (England). The Reactor Group.
FRACTURE TOUGHNESS OF 0.36 PERCENT CARBON STEEL AS REVEALED BY THE INSTRUMENTED CHARPY IMPACT TEST
P. Terry 30 Aug. 1968 19 p refs
(TRG-1776 (C) Avail: CFSTI; UK 3s

It is shown that, using the instrumented Charpy impact machine, valid fracture toughness values can be obtained for a low-strength steel from fatigue cracked Charpy specimens. The results obtained compare very favorably with results available from other tests on the same material. Author (NSA)

N69-34286# Aerospace Corp., El Segundo, Calif. Lab. Operations
PROPAGATION OF A SHEAR PULSE IN A DISPERSIVE MEDIUM
Charles Sve 25 Feb. 1969 16 p refs
(Contract F04701-68-C-0200)
(AD-688484; TR-0200(4240-30)-2; SAMSO-TR-69-150) Avail: CFSTI CSCL 20/11

A laminated half-plane is subjected to a suddenly applied shear stress. The particle velocity is determined using the effective stiffness theory. Far-field results are obtained with the head of the pulse procedure. Author (TAB)

N69-34317# Stanford Univ., Calif. Dept. of Applied Mechanics.
CRACK EXTENSION IN TRANSVERSELY LOADED ELASTIC PLATES
David Owen Harris May 1969 188 p refs
(Contract DA-31-124-ARO/D-251)
(AD-688661; AROD-4800.15-MC; TR-8) Avail: CFSTI CSCL 20/11

Running cracks in elastic plates have been observed to be arrested as they pass under a zone of externally applied transverse compression. This phenomenon has been observed in a variety of brittle materials, such as beryllium, glass, tungsten, and graphite, and has been used to produce controlled precracks in fracture toughness specimens of materials that are difficult to fatigue crack. In addition to this practical application, this phenomenon could prove useful in arresting cracks in actual structures, thereby providing a fail-safe design and decreasing the likelihood of catastrophic failure. The purpose of the investigation was to examine the mechanics of this crack arrest from both theoretical and experimental standpoints, and to thus determine the controlling geometrical and material parameters. Author (TAB)

N69-34384# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
ELASTO-PLASTIC ANALYSIS OF ORTHOTROPIC PLATES AND SHELLS Final Technical Report, Sep. 1967 - Oct. 1968
Benjamin Whang Oct. 1968 319 p refs
(Contract N00014-67-A-0204-0021)
(AD-688471; R68-83) Avail: CFSTI CSCL 20/11

A finite element displacement method is developed for the elasto-plastic analysis of bi-linear strain-hardening orthotropic plates and shells. Two basic approaches in the elasto-plastic analysis, the initial stiffness approach and the tangent stiffness approach are presented and compared. Three separate computer programs have been written; the first two are for the plane stress case. The third program is for the rectangular shallow shells, and it uses elements whose thicknesses are subdivided into equally-spaced layers, each of which is assumed to be in plane stress. Author (TAB)

N69-34423# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NATURAL FREQUENCIES OF A PLATE WITH A TIME-VARIABLE MODULUS OF ELASTICITY
V. Ts. Gnuni Mar. 1969 8 p Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Mekhan. (EREVAN), v. 20, no. 4, 1967 p 3-5
(AD-687237; FTD-HT-23-1081-68) Avail: CFSTI CSCL 20/11

The natural frequencies of a thin, isotropic, simply supported rectangular plate of constant thickness with sides a and b is discussed. The modulus of elasticity of the plate material varies with time. Assuming that the hypothesis on the preservation of normals is valid, and taking into account the inertia forces of the plate, a second-order differential equation is written (in accordance with S. P. Timoshenkos theory) which describes the free vibration of the plate under discussion. A solution of this equation, analogous to that used by the author in investigating the vibration of a thin plate in a high-temperature field, is written which is correct only for certain instants during vibration. TAB

N69-34469# Aerospace Corp., San Bernardino, Calif.
SHOCK PROPAGATION IN A STRAIN HARDENING MATERIAL Technical Report, Jun. 1966 - Nov. 1968
P. J. Rausch 6 Jun. 1969 49 p refs
(Contract F04701-68-C-0200)
(AD-688487; TR-0200(S4816-71)-1; SAMSO-TR-69-165) Avail: CFSTI CSCL 11/6

Weak shock theory is used to analyze the propagation of the stress waves which are induced by nonuniform, instantaneous, internal heating of a nonlinearly elastic, semi-infinite solid. The material nonlinearity considered is caused by the increase in bulk modulus which occurs as the hydrodynamic stress component increases. Heating is assumed to occur instantaneously. Since the shock is assumed to be weak, the entropy change across it is negligible, and therefore the wave form both behind and in front of the shock is found by using a coordinate perturbation method to solve the nonlinear equations for constant entropy. This solution predicts a multivalued material state in the vicinity of the shock front without locating the front itself. The location of the shock front is found separately by using the principle of momentum conservation. If the front is then inserted at this location, a wave form is obtained for which the material state is everywhere single-valued. Author (TAB)

N69-34481# RAND Corp., Santa Monica, Calif.
NUMERICAL RESULTS FOR LAMB'S POINT LOAD PROBLEM
D. C. Gakenheimer May 1969 9 p refs Submitted for publication
(AD-687968; P-4089) Avail: CFSTI CSCL 20/11

Displacement-time histories are presented in this paper for Lambs point load problem. TAB

N69-34483# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
ENERGY DISTRIBUTION IN AN OPTIMUM STRUCTURAL DESIGN
V.B. Venkayya, N. S. Khot, and V. S. Reddy Mar. 1969 71 p refs
(AD-688489; AFFDL-TR-68-156) Avail: CFSTI CSCL 13/13

An automated procedure is presented for minimum weight design of structures. It is an iterative procedure in which the design for the next cycle is determined by the study of the strain energy distribution in the present cycle. The displacement method of analysis is used in developing the method. Other methods of

analysis which have the capability to determine the strain energy in various parts of the structure should be applicable. Designs in the presence of stress constraints and stress and displacement constraints are also considered. Where there are only stress constraints, a simple iteration based on the study of the energy distribution is adequate. In the presence of displacement constraints, the design is carried out in two stages. The first stage of iteration is similar to that in stress constraint problems and the second stage is based on a search procedure. Examples of two and three dimensional bar structures are presented to illustrate the effectiveness of the method. It proved to be extremely efficient in arriving at minimum weight structures. Author (TAB)

N69-34549# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON BUCKLING MODES OF ELASTIC SHELLS UNDER INTENSIVE LOADING
V. M. Kornev [1969] 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverd. Tela (Moscow), no. 2, 1969 p 129–135
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Estimates of the rate of growth of the natural buckling modes of elastic shells under small perturbations are given, and the stress redistribution in the middle surface during buckling is investigated. It is shown that the solution obtained for a hinge-supported shell is the asymptote of the solution under arbitrary boundary conditions. The asymptote of the solution is constructed, taking into account the simple edge effect during vibrations and stability. A comparison between experimental and computed results is presented. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-33225# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A CLASS OF TWO-PHASE STATE EQUATIONS
George D. Kahl Mar. 1969 30 p refs
(AD-687269; BRL-1429) Avail: CFSTI CSCL 20/13

The properties of a particular class of elementary, two-phase state equations are found to be simply related. The class includes some familiar equations, such as the Van der Waals, Berthelot, and Clausius types, as well as a form recently suggested by J. J. Martin. Conditions for stable equilibrium are given, and some examples are compared. A table of values is included which can be used with elementary transformations to find the equilibrium coexistence properties of any member of the set. A drawback for this type equation along the critical isotherm is noted. Author (TAB)

N69-33288*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RADIATIVE HEAT TRANSFER FROM SATURN EXHAUST PLUMES
Robert M. Huffaker *In its* Res. Achievements Rev., Vol. 3 1968 p 81–90 refs (See N69-33289 19-31)
Avail: CFSTI CSCL 20M

For calculating radiative heat transfer through inhomogeneous, Saturn-type exhaust plumes, a band model approach was used to represent the absorption and emission characteristics of the exhaust gases. A modified Curtis–Godson approximation is used in the radiative heat transfer calculations and effectively averages the band model parameters over the inhomogeneous path. This technique was shown to be accurate for strong gradients in temperature and concentration. The difference between the measured inhomogeneous transmittance and that calculated by the modified Curtis–Godson approximation was within the experimental error and was not greater than 0.02. Author

N69-33306*# McDonnell-Douglas Astronautics Co., Richland, Wash. Dowel W. Douglas Labs.
RADIOISOTOPE HEATER DEVELOPMENT PROGRAM Summary Report
M. W. Hulin [1969] 21 p
(Contract NAS9-8846)
(NASA-CR-101841; DAC-63371) Avail: CFSTI CSCL 20M

A preliminary design and program planning study of a family of small 1 to 50W radioisotope heaters for manned spacecraft thermal control applications covering mission times of from 14 days to 5 years was conducted. A survey of manned spacecraft programs was also conducted to determine current and future thermal requirements for space components, and potential applications for radioisotope heaters. Approximately 37 applications were identified, requiring 180 to 300 heaters ranging in power from <1 to over 100W. Safety, design, and materials criteria was determined, and reference heater designs developed. Safety and optimization analyses were performed; manufacturing processes and quality assurance programs identified; and program plans and cost estimates formulated. Results of the optimization analyses indicate that two heater sizes, 10 and 50 W, using two isotopic fuels, promethia and plutonia, will satisfy the majority of identified applications and missions. Author

N69-33314*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF TOTAL-PRESSURE LOSS AND AIRFLOW DISTRIBUTION FOR ANNULAR GAS TURBINE COMBUSTORS
Robert R. Tacina and Jack Grobman Washington Aug. 1969 44 p refs
(NASA-TN-D-5385) Avail: CFSTI CSCL 21H

A computer program was used for the analysis of the annular gas turbine combustor, and the effects of a number of geometric and flow variables on the total pressure loss and airflow distribution. The results, where comparable, agree very well with previously calculated tubular combustor data. The following are significant extensions to the previously available data: (1) an increased range of open hole area in the dome, (2) combined effect of reference Mach number and heat release, (3) the use of a liner hole with a scoop and, (4) the use of a liner in which the cross sectional area varies with length. Author

N69-33387# Lucas Gas Turbine Equipment, Ltd., Burnley (England).
A.R.C. HEAT AND MASS TRANSFER SUBCOMMITTEE PROPOSED NOMENCLATURE FOR FILM COOLING INVESTIGATIONS
J. Odgers and B. R. Smith London HMSO 1969 15 p Supersedes ARC-28935
(ARC-R/M-3587; ARC-28935) Copyright. Avail: CFSTI; HMSO 6s 6d

The report contains tables of recommended terminology for film cooling investigations. Wherever possible the proposed

symbol has been taken from the British Standard 1991, part 1: 'General Letter Symbols, Signs and Abbreviations' incorporating amendments issued July, 1955, February, 1957 and October, 1960. In addition it has been the aim of the authors, wherever possible, to avoid duplication of symbols and also to suggest symbols of a suitable form for printing and report purposes. Author (ESRO)

N69-33524# Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.
MEASURING THE CRITICAL HEAT FLUX ON THE BAR SHEATH WHICH IS COOLED BY WATER UNDER HIGH PRESSURE [MISURE DI FLUSSI TERMICI CRITICI SU FASCI DI BARRE REFRIGERATE CON ACQUA AD ALTA PRESSIONE]
A. Campanile, G. Fumero, G. Galimi, and M. Goffi 1968 21 p refs In ITALIAN Presented at 23rd ATI Natl. Congr. on Hermonucl. Res., Bologna, 25-27 Sep. 1968 Sponsored in part by EURATOM
(SORIN-153; M/355) Avail: CFSTI

The heat exchange in a test section of new bar bundles, electrically heated, and cooled by boiling water under high pressure is described. Numerous experiments are tried on the test section directed toward determining the critical thermal flux, and locating the priming point for the thermal flow. The results of the first series of the tests on the bundle of new bars, arranged in square reticules so that the geometry does not present a unique configuration, are described and analyzed. Transl. by F.O.S.

N69-33727# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
SYSTEM FOR VACUUM TREATMENT AND NITROGEN EQUILIBRIUM AT 1200 TO 2000°C
C. M. Fitzpatrick and J. M. Leitnaker Mar. 1969 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2429) Avail: CFSTI

An apparatus is described that was designed primarily to provide basic thermodynamic data in the studies of carbonitrides at 1000 to 2000°C at nitrogen pressure from 2 torr to 1 atm. Constant temperature can be maintained in a uniform hot zone during the time of the run at the selected pressure of nitrogen. The sample can be lowered into or raised from the hot zone by a sliding water-cooled rod. Pressures of nitrogen were measured with a cathetometer and a mercury manometer to better than 0.1 torr. Temperatures were determined using a sight port with a calibrated optical pyrometer on a black body. Author (NSA)

N69-33798# Los Alamos Scientific Lab., N.Mex.
SUMMARY OF THEORETICAL ASPECTS OF HEAT TRANSFER PERFORMANCE IN CLUSTERED ROD GEOMETRIES
Roy A. Axford (Ill. Univ., Urbana) [1968] 51 p refs Presented at Ann. ASME meeting, Los Angeles
(Contract W-7405-eng-36)
(LA-DC-9786; CONF-681102-2) Avail: CFSTI

Theoretical predictions of asymptotic Nusselt numbers and peripheral temperature and heat flux variations on the rod casing wall are summarized for rod cluster geometries for fully developed heat transfer with an axially uniform heat flux. The related hydrodynamic problems for fully developed laminar and turbulent flows are also considered. Single and multiregion models of rod clusters are presented. Author (NSA)

N69-33845# California Univ., Berkeley. Div. of Applied Mechanics.
ON HEAT CONDUCTION AND WAVE PROPAGATION IN RIGID SOLIDS
D. B. Dogy and P. M. Naghd Mar. 1969 34 p refs
(Contract N00014-67-A-0114)
(AD-687706; AM-69-6) Avail: CFSTI CSCL 20/13

The paper is concerned with conduction of heat and the related problem of propagation of thermal waves in stationary rigid solids. Special attention is given to rate-dependent response and the ensuing conditions of propagation in the conducting medium. By considering small time-dependent temperature variations superposed on a finite nonuniform equilibrium temperature field, certain conclusions are reached on the so-called second sound phenomenon. Author (TAB)

N69-33876*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
THERMAL ANALYSIS OF SMALL CYLINDRICAL AMMONIA EVAPORATORS
David J. Gilson (RAE, Farnborough) Paris ESRO Feb. 1969 83 p Sponsored by ESRO and NASA
(ESRO-SN-83; AE-6706) Avail: CFSTI

An analysis is presented of the steady state thermal behavior of small tubular evaporators filled with porous thermally conducting material and exchanging heat by conduction with a hypothetical spacecraft mass. A particular application is examined in quantitative detail and the criteria for the choice of evaporator shape are discussed. A special type of evaporator construction is derived and compared with the simple type. An experimental correlation with the theory is performed. Brief consideration is also given to the transient evaporator conditions. Author (ESRO)

N69-33996# Iowa State Univ. of Science and Technology, Ames.
THERMAL CONDUCTIVITY OF THORIUM
Heinrich Gustav Schettler (M.S. Thesis) Feb. 1969 46 p refs
(Contract W-7405-eng-82)
(IS-T-298) Avail: CFSTI

The thermal conductivity and the electrical resistivity of high-purity thorium samples were measured as functions of temperature from 3 to 300°K. The steady-state heat flow method was used for the thermal conductivity measurements. Between 6 and 25°K, the ideal electrical resistivity showed a $T^{3.75}$ temperature dependence. Above 60°K the resistivity was found to depend linearly upon temperature. The thermal conductivity was an order of magnitude greater than the thermal conductivity previously reported on less-pure samples. Above 60°K the thermal conductivity was found to be constant for the purest samples contrary to previous reports which gave a linear increase. From the lowest temperatures to the maxima of the thermal conductivity curves a linear temperature dependence indicated impurity and lattice-defect scattering to be dominant. Impurity scattering was appreciable to about 20°K. Author (NSA)

N69-34034*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RELAXATION OF SELF-OSCILLATION DURING THE COMBUSTION OF GUNPOWDER IN A SEMICLOSED VOLUME [RELAKSATSIONNYYE AVTOKOLEBANIYA PRI GORENII POROKHA V POLUZAMKNUTOM OBYEME]
G. N. Gusenkov 23 May 1969 7 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), Sep.-Oct. 1968 p 44-46
(Contract NAS7-100)
(NASA-CR-103879) Avail: CFSTI CSCL 21B

The potential of oscillatory effects during the combustion of gunpowder has been indicated. In approximations close to harmonic, the question of self-oscillation at constant pressure and forced oscillations during a change of pressure were examined.

However, the results of these efforts were changed only for such combustion regimes as when a corresponding problem is mildly nonlinear. With strong nonlinear dependencies, the analogous problem is not solved. An attempt to fill that gap in some measure for a case where the combustion of gunpowder occurs in a semiclosed volume and the oscillations are close to disruptive is presented. Author

N69-34078# Lockheed Missiles and Space Co., Sunnyvale, Calif.
RADIATIVITY AND SPECTRUM ABSORPTION COEFFICIENTS OF COMBUSTION PRODUCTS
Iu. A. Plastinin [1969] 7 p refs Transl. into ENGLISH from Prikl. Mekh. i Tech. Fiz. (USSR), no. 2, 1969 p 86–92
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The determination of the spectrum absorption coefficients and radiativities of a mixture of combustion products consisting of CO_2, H_2O, CO, OH, HCl, HF, H_2, NO molecules in thermodynamic equilibrium in the 2000 to 5000 degree K temperature range is discussed. The proposed method of analysis, based on utilization of a graph of the molecular absorption coefficients reduced to atmospheric pressure, permits calculation of these coefficients and radiativities for any mixture of gases consisting of the enumerated molecules. Author

N69-34133# RAND Corp., Santa Monica, Calif.
THE THERMODYNAMICS OF THE BORON CARBIDE/BORON-CARBON VAPOR SYSTEM
F. J. Krieger Mar. 1969 42 p refs
(Contract F44620-67-C-0045)
(AD-687435; RM-5958-PR) Avail: CFSTI CSCL 20/13

An investigation of the thermodynamic properties of boron carbide over a range of temperatures up to 6000 deg K and pressures up to 1000 atmospheres. Two sets of equilibrium composition equations are used--one representing a pure gas phase, the other a heterogeneous system of gas and condensed (solid or liquid) boron carbide. The gas phase of the heterogenous chemical system, like the homogeneous gas phase, comprises 23 gaseous boron-carbon species. The results of the computational program are presented in both tabular and graphic form. The latter is a conventional Mollier diagram in which specific enthalpy is plotted against specific entropy, with cross plots of temperature, pressure, and molecular weight or moles of condensed boron carbide. Author (TAB)

N69-34198*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE THERMODYNAMIC PROPERTIES OF SOLID MERCURY AT TEMPERATURE INTERVALS OF FROM O°K TO MELTING POINT AT NORMAL PRESSURE [TERMODINAMICHESKIYE SVOYSTVA TVERDOY RTUTI V INTERVALE TEMPERATUR OT O K DO TOCHKI PLAVLENIYA PRI NORMALNOM DAVLENII]
12 Aug. 1969 33 p refs Transl. into ENGLISH from Teplofiz. Kharakteristiki Veshchestv (Moscow), Issue 1, 1968
(Contract NAS7-100)
(NASA-CR-103884) Avail: CFSTI CSCL 20M

The thermodynamic properties of solid mercury at temperature intervals of from 0 deg K to melting point at normal pressure have been investigated. Thermotechnical tables of mercury characteristics were prepared. The properties of saturated and burned out gas are considered up to 1000 degC and 800 bar, and an i-s diagram is constructed. The results of the experiment, which relate to viscosity and heat transfer are thoroughly analyzed. The possibility of the interaction potential are considered as well as the possibility of error in determining its parameter in relation to viscosity. A fairly complete bibliography about the properties of mercury with references published before 1955 is also included. Author

N69-34224# Texas Univ., Austin. Computation Center.
THE CONVERGENCE OF RICHARDSON'S FINITE DIFFERENCE ANALOGUE FOR THE HEAT EQUATION Interim Technical Report
Harold D. Eidson, Jr. (M.S. Thesis) May 1969 113 p refs
(Grants DA-ARO(D)-31-124-G721; NSF GP-5253)
(AD-688860; AROD-3772-43-M; ITR-20) Avail: CFSTI CSCL 20/13

The theoretical convergence of Richardsons finite-difference analogue for the partial differential equation of heat flow is proved, and substantiating numerical results obtained from a high-speed digital computer are given. An analogy is drawn between the stability and convergence of Richardsons method in the discretization of partial differential equations and that of Mines Method I in ordinary differential equations. The numerical instability of Richardsons method is discussed. Concluding remarks disclose that although theoretical convergence is valid, numerical application of the method is limited due to the round-off error resulting from extremely small mesh sizes required for convergence. TAB

N69-34406# Rocket Propulsion Establishment, Westcott (England).
THE ESTIMATION OF REACTION RATIO FLUCTUATIONS IN ROCKET COMBUSTION GASES FROM GAS-SAMPLING MEASUREMENTS
A. J. Cruttenden Oct. 1968 19 p refs
(RPE-TR-68/9/UL) Avail: CFSTI

A theory on fluctuations in turbulent flames has been extended to allow the estimation of the root-mean-square fluctuation of reaction ratio in rocket combustion chamber gases. Values calculated from published gas analyses range from 9 to 18 percent. Author

N69-34509# Oak Ridge National Lab., Tenn.
APPLICATION OF THERMODYNAMICS TO THE DEVELOPMENT OF INDUSTRIAL PURIFICATION METHODS OF REFRACTORY METALS AND SEMI-METALS
Andre Accary Jul. 1968 20 p refs Transl. into ENGLISH from French Rept. CEA-R-3390
(ORNL-tr-2101; CEA-R-3390) Avail: CFSTI

Application of electron beam melting for purification of metals is examined. Examples of purification thermodynamics are given using the cases of V and UC. NSA

N69-34573# Harvard Univ., Cambridge, Mass. Engineering Sciences Lab.
FILM BOILING ON VERTICAL SURFACES
Edward Marc Greitzer Jun. 1969 262 p refs
(Contract NSF GK-1088)
(TR-1) Avail: Issuing Activity

Boiling heat transfer on vertical surfaces in the film and transition regimes was studied, and the fundamental problems connected with the film boiling phenomenon, natural convection, and saturated film boiling on vertical surfaces were analyzed. The heat transfer surface was a vertical tube, which was heated on the inside by condensing steam and on the outside of which the heat transfer liquid (methanol) boiled. Curves of the heat flux versus the difference between wall and saturation temperatures are included. It is concluded that the high heat fluxes indicate that in the presence of both high velocity and large subcooling, the transition from nucleate to film boiling may be accomplished without significant decrease in heat flux. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-33220# Congress. House. Committee on Science and Astronautics.
NASA AUTHORIZATION, 1970: INDEX FOR HEARINGS ON HR-4048, HR-10251 (SUPERSEDED BY HR-11271) FOR PARTS 1-4
Washington GPO 1969 313 p Hearings before Comm. on Sci. and Astronaut., 91st Congr., 1st Sess.
Avail: SOD $1.25

Indexes separated as to personal names and subject are presented for: (1) the Full Committee on Science and Astronautics; (2) the Subcommittee on Manned Space Flight; (3) the Subcommittee on Space Science and Applications; and (4) the Subcommittee on Advanced Research and Technology. K.W.

N69-33762# Aeronautical Research Council (Gt. Brit.)
PUBLISHED REPORTS AND MEMORANDA OF THE AERONAUTICAL RESEARCH COUNCIL (NOS. 3451 TO 3550)
1969 11 p refs
(ARC-R/M-3550) Copyright. Avail: CFSTI; HMSO 6s

This paper lists one hundred titles which have been published in the Reports and Memoranda series of the Aeronautical Research Council and placed on sale by H.M. Stationary Office. Author (ESRO)

N69-33821# Royal Aircraft Establishment, Farnborough (England).
SEGMENT, A BUILDING BLOCK OF SPEECH [DAS SEGMENT, EIN BAUSTEIN DER SPRACHE]
H. Kirsch Mar. 1969 18 p refs Transl. into ENGLISH from NTZ-Nachr. Z. (Brunswick), v. 20, no. 9, Sep. 1967 p 495-501 (RAE-Lib-Trans-1365) Avail: CFSTI

The article shows that allophones are not the physically smallest units of speech signals. In the case of vowels, which are investigated, the allophone consists of several repeated, almost similar, segments; the allophone is characterized by its segments. The nature of the segment can be investigated by oscillographic analysis of speech signals. The segment can be isolated automatically. By means of some recorded typical segments for vowels a, o, u, e, i, ü, ö and ä it is shown that not the precise time variation but the structure of the segment is important. The structural investigation of the segment leads to a classification of these vowels which is independent of the speaker and is equivalent to the phonetic configuration. The classification is based on α and β types which can be derived from the signal structure without frequency analysis. Some references are made about the extension of the classification to consonants and about the difficulties in automatic speech recognition. Author

N69-33844# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[PUBLICATIONS AND REPORTS] Quarterly Progress Report
Apr. 1969 299 p refs
(Contracts DA-28-043-AMC-02536(E); F19628-69-C-0044)
(AD-687674; QPR-93) Avail: CFSTI CSCL 9/3

Contents: Interatomic forces; Electron magnetic resonance, excited states of carbonyl hydrocarbons; Radio astronomy, pulsar studies, observations of OH emission associated with infrared stars, observations of radio emission from galactic H2O; Solid-state microwave electronics; Electrodynamics of media; Plasmas and controlled nuclear fusion, observation of ion acoustic waves in highly ionized plasmas in a magnetic field, nonlinear coupling of three ion acoustic waves, relation between moving striations and ion acoustic waves; Plasma diagnostics; Applied plasma research, stability of electron beams with velocity shear, acoustic-wave propagation and amplification in InSb, gain of a CO2 laser amplifier in the afterglow; Processing and transmission of information, multiple fault detection in combinational logic networks, bounds and approximations for some integral expressions involving log-normal statistics; Detection and estimation theory; Speech communication; Cognitive information processing, computer synthesized holograms - two experiments; Neurophysiology. TAB

N69-33860# National Aeronautics and Space Administration, Washington, D.C.
TRANSFERABLE TECHNOLOGY: PUBLICATIONS REPORTING INNOVATIONS SUITABLE FOR MANY PURPOSES, FALL 1969
1969 17 p refs
(NASA-TM-X-61757) Avail: CFSTI CSCL 05B

A list is presented of the Special Publications and Tech Briefs which are published by NASA to inform potential users outside the aerospace industry about the findings and innovations reported by NASA Research Centers, contractors, and subcontractors. Prices and ordering instructions are included. Author

N69-34000# Federal Council for Science and Technology, Washington, D.C. Committee on Scientific and Technical Information.
GUIDELINES TO FORMAT STANDARDS FOR SCIENTIFIC AND TECHNICAL REPORTS PREPARED BY OR FOR THE FEDERAL GOVERNMENT National Aeronautics and Space Administration Implementation Edition
Jul. 1969 18 p refs
Avail: NASA Scientific and Technical Information Division CSCL 5/2

This standard establishes format requirements for scientific and technical reports prepared by or for the Federal government. Its purposes are to aid the interchange of scientific and technical information, and to reduce the costs of preparing, storing, retrieving, reproducing, and distributing such reports. This standard applies to reports furnished in the following forms: manuscript, reproducible copy, reproduced copy, and microform. Author

N69-34012# George Washington Univ., Washington, D.C.
THE SYSTEMS APPROACH AND THE URBAN DILEMMA
Robert G. Smith Jul. 1968 50 p refs
(PB-182869; SDP-101) Avail: CFSTI CSCL 13B

The report is concerned with the application of advanced R and D systems concepts and skills to the analysis and management of critical domestic problems such as urban renewal, air pollution, traffic congestion, and inadequate housing. It is based on a study of selected books, documents and articles, and on discussions with responsible and knowledgeable individuals in the Federal Government, research institutes and private industry. Author (USGRDR)

N69-34105# IIT Research Inst., Chicago, Ill.
EMP THREAT AND COUNTERMEASURES FOR CIVIL DEFENSE SYSTEMS
J. E. Bridges and J. Weyer Nov. 1968 49 p refs
(Contract DAHC20-68-C-0198)
(AD-687349) Avail: CFSTI CSCL 15/3

PUBLIC COLLECTIONS OF NASA DOCUMENTS

A brief introductory discussion of the nuclear electromagnetic pulse (EMP) and its effects on electrical/electronic equipment is presented with lists of precautionary measures which may be taken prior to, during, and following a nuclear attack. The primary purpose of these precautions is to minimize the damaging effects of the EMP on population survival and post-attack recovery.
Author (TAB)

N69-34114# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
ON THE GAS LAYER SURROUNDING A PROJECTILE BEING FIRED FROM A SMOOTH BORE GUN
Edward F. Ehlers Apr. 1969 23 p refs
(AD-688598; D1-82-0834) Avail: CFSTI CSCL 19/6

An analysis of the gas envelope surrounding a projectile being fired from a smooth bore gun is presented. By reducing the equations of stress and strain in an accelerated body to dimensionless form and examining the dimensionless parameters, it is shown that the strains in an accelerated body do not increase with increasing acceleration if the pressure surrounding the body is increased proportionately, provided Poissons ratio remains constant and Youngs modulus increases with the applied pressure. A simple analysis on the assumption of parallel flow is given for the flow in the gap between the moving projectile and the gun barrel. For constant gas properties, the shear stress on the projectile and on the gun barrel and the pressure gradient are constant. For isothermal flow in the slot, the shear stress on the projectile increases toward the low pressure end approaching asymptotically the Couette flow value. For mass flow rate in the slot below a certain value, the shear stress acts as a thrust on part of the projectile near the high pressure end and a drag on the leading edge or low pressure end.
Author (TAB)

N69-34124# Toronto Univ. (Ontario). Inst. for Aerospace Studies
A COMPREHENSIVE SURVEY OF PASSENGERS FLYING FROM TORONTO INTERNATIONAL AIRPORT, MAY–JUNE 1968
Murray G. Mc Leod Aug. 1969 76 p refs
(UTIAS-TN-141) Avail: CFSTI

A departure lounge survey was made of scheduled outbound passengers at Toronto International Airport in 1968 from May 27th to June 2nd, covering about 6 percent of all outbound passengers during the survey week. The survey measured the following characteristics of Toronto air travellers: age, sex, marital status, income, residence, occupation, work of employer, frequency of travel by air, trip purpose, means of transportation on to the airport, and travel time to the airport. In addition, maps were produced which showed the origin pattern of the air travellers. Sufficient data was collected for performing a correlation analysis to formulate zonal passenger generation equations using land use and socio-economic data. The second part of the thesis deals with airport access: driving time to the airport, the various means of transportation to the airport and the corresponding fares and travel times.
Author

N69-34151# Cambridge Univ. (England). Cavendish Lab.
GROWTH OF BURNING TO DETONATION IN LIQUIDS AND SOLIDS Progress Report, Dec. 1968 – Apr. 1969
David Tabor Apr. 1969 11 p
(Grant AF-EOAR-0044-69)
(AD-688625; AFOSR-69-1397TR; PR-1) Avail: CFSTI CSCL 19/2

An investigation is being made of deflegration and growth to detonation in liquids and solids with special reference to the role of small discontinuities in promoting sensitivity, and the Deflagration, Detonation Transition. As with previous reports it will be seen that the approach has been on a fairly broad front covering a range of experimental studies. The results are discussed under separate headings.
Author (TAB)

N69-34289# Air Force Office of Scientific Research, Arlington, Va.
PLANNING PHENOMENA-ORIENTED RESEARCH IN A MISSION-ORIENTED ORGANIZATION
Howard M. Vollmer ed., John K. Galt, Guilford L. Hollingsworth, Donald C. Pelz, William J. Price et al Sep. 1968 59 p refs
Presented at the 12th Inst. on Res. Admin., Washington, D.C., 24-27 Apr. 1967 Prepared in Cooperation with Am. Univ.
(AD-675991; AFOSR-68-1759) Avail: CFSTI CSCL 05/1

CONTENTS:

1. PLANNING PHENOMENA-ORIENTED RESEARCH IN THE BOEING COMPANY G. L. Hollingsworth (Boeing Sci. Res. Labs.) p 4–10 refs (See N69-34290 19-34)
2. PLANNING PHENOMENA-ORIENTED RESEARCH IN THE BELL TELEPHONE LABORATORIES J. K. Galt (Bell Tele. Labs., Inc.) p 11–20 (See N69-34291 19-34)
3. PLANNING PHENOMENA-ORIENTED RESEARCH IN NASA L. C. Van Atta (NASA). Washington p 21–28 (See N69-34292 19-34)
4. PLANNING PHENOMENA-ORIENTED RESEARCH IN AFOSR W. J. Price p 30–45 refs (See N69-34293 19-34)
5. SOME FINDINGS FROM STUDIES OF SCIENTISTS IN ORGANIZATION D. C. Pelz (Mich. Univ.) p 46–55 (See N69-34294 17-34)

N69-34290# Boeing Scientific Research Labs., Seattle, Wash.
PLANNING PHENOMENA-ORIENTED RESEARCH IN THE BOEING COMPANY
Guilford L. Hollingsworth *In* AFOSR Planning Phenomena-Oriented Res. in a Mission-Oriented Organ. Sep. 1968 p 4–10 refs (See N69-34289 19-34)
Avail: CFSTI

Practical considerations in phenomenon oriented research center on the determination of the scientific area to be worked on and then finding the best qualitifed people for this particular research. Research management has to define the effort to be cooperative or competitive before making a personnel selection.
G.G.

N69-34291# Bell Telephone Labs., Inc., New York. Solid State Electronics Research Lab.
PLANNING PHENOMENA-ORIENTED RESEARCH IN THE BELL TELEPHONE LABORATORIES
John K. Galt *In* AFOSR Planning Phenomena-Oriented Res. in a Mission-Oriented Organ. Sep. 1968 p 11–20 (See N69-34289 19-34)
Avail: CFSTI

Managing phenomenon oriented research requires the recruitment of competent scientists for a particular job as well as the selection of the best motivated manager for directing the various projects. Since scientist do not make necessarily the best research managers, qualified volunteers asking to be in charge of a program are considered a best selection.
G.G.

N69-34292# National Aeronautics and Space Administration, Washington, D.C.
PLANNING PHENOMENA-ORIENTED RESEARCH IN NASA
Lester C. Van Atta *In* AFOSR Planning Phenomena-Oriented Res. in a Mission-Oriented Organ. Sep. 1968 p 21–28 (See N69-34289 19-34)
Avail: CFSTI

Personnel planning for basic and applied research in a mission oriented organization is most rewarding when the research is combined with advanced development. Long range and short range plans must be considered and used to encorporate motivation for bold and imaginative approaches. Critical prerequisites for research planning are: (1) a critical mass of capability in each subject matter area; (2) an adequate range of disciplines representing general areas of interest; (3) a stable research budget with workable allocations; (4) the patience of top management during initial periods; (5) the freedom from detailed short range engineering responsibilities; and (6) close communications between all participants in order to relate plans to goals. G.G.

N69-34293# Air Force Office of Scientific Research, Arlington, Va.

PLANNING PHENOMENA-ORIENTED RESEARCH IN AFOSR

William J. Price *In its* Planning Phenomena-Oriented Res. in a Mission-Oriented Organ. Sep. 1968 p 30-45 refs (See N69-34289 19-34)

Avail: CFSTI

The role of the Air Force Office of Scientific Research in the Air Force research, development, and systems acquisition program is discussed. The application of proper planning procedures requires the distribution of fundings and the optimization of manpower for the diverse projects. Current interest centers on the determination of the value of technological forecasting as an input of research planning; this requires diverse communication functions and increased research in behavioral sciences. G.G.

N69-34294# Michigan Univ., Ann Arbor. Inst. for Social Research.

SOME FINDINGS FROM FROM STUDIES OF SCIENTISTS IN ORGANIZATIONS

Donald C. Pelz *In* AFOSR Planning Phenomena-Oriented Res. in a Mission-Oriented Organ. Sep. 1968 p 46-55 (See N69-34289 19-34)

Avail: CFSTI

Organizational behavior of scientists and engineers in research and development laboratories was studied by evaluating their technical or scientific contributions as judged by colleagues as well as their contributions to the organization's objectives. Also evaluated were the numbers of papers published and unpublished, patents and patent applications, and climatic effects on performances. Results showed that scientists and engineers were often effective under conditions with pressures in apparently opposite directions; this challenge stimulated creative individuals to optimal performances. G.G.

N69-34445# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

WATER SUPPLY IN COLD REGIONS

Amos J. Alter Jan. 1969 94 p refs

(AD-685850; CRREL-CRSE-3-C5A) Avail: CFSTI CSCL 13/2

The monograph outlines the influence of a cold environment on sanitary engineering works and services. It then deals with water supply in cold regions: sources, distribution systems, treatment processes and possible future supply from other than geological sources. Author (TAB)

N69-34538# Northern Electric Co., Ltd. Otawa (Ontario).

SOME INTERNATIONAL ASPECTS OF RELIABILITY QUALITY CONTROL

E. H. Hayes [1969] 22 p refs Presented at the 1969 ASQC/SRE Reliability and Quality Control Seminar, Niagara Falls (Ont)

Avail: CFSTI

A number of international activities on reliability and quality and their significance, particularly with respect to their impact on North American industrial firms having export markets are reviewed in this paper. Not every activity of international significance is reported upon, and mention is restricted to those conferences and symposia which have broad international influence. Author

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EUROPEAN

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